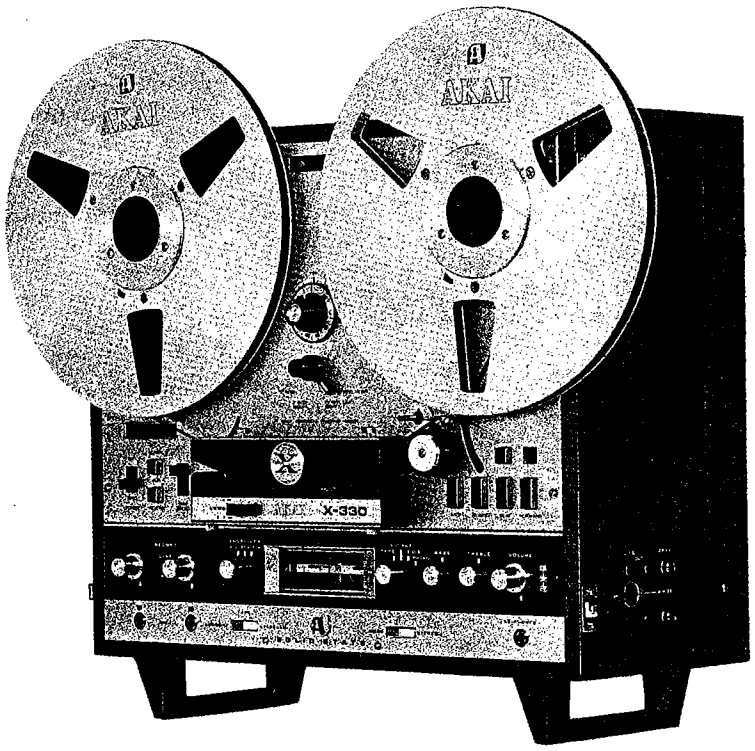
SERVICE MANUAL

AKAI TAPE RECORDER

MODEL X-330

ALSO APPLICABLE FOR MODEL X-330D



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I. SPECIFICATIONS

SPECIFICATIONS

POWER SUPPLY : AC 100 to 240 V, 50 or 60 Hz

RECORDING SYSTEM
: In-line 4 Track Stereo, monaural recording by using Cross-field Bias Head.

TAPE SPEED : 1-7/8, 3-3/4, 7-1/2 ips.

TAPE SPEED DEVIATION
: Within ±0.8% at 7-1/2 ips.
Within ±1.2% at 3-3/4 ips.
Within ±1.2% at 1-7/8 ips.

WOW AND FLUTTER
: Less than 0.13% r.m.s. at 7-1/2 ips.
Less than 0.23% r.m.s. at 3-3/4 ips.
Less than 0.33% r.m.s. at 1-7/8 ips.

FREQUENCY RESPONSE
(at Line Output, Recording Level 1000 Hz – 20 VU)
: 30 to 22,000 Hz ± 3 dB at 7-1/2 ips.
30 to 18,000 Hz ± 3 dB at 3-3/4 ips.
30 to 9,000 Hz ± 4 dB at 1-7/8 ips.

SIGNAL TO NOISE RATIO
(at Line Output) : Greater than 44 dB at 7-1/2, 3-3/4, 1-7/8 ips.

TOTAL HARMONIC DISTORTION
(at Line Output 1,000 Hz – 0 VU Rec/P.B.)
: Within 4% at 7-1/2, 3-3/4, 1-7/8 ips.

RECORDING INPUT
MICROPHONE : Above 0.7 mV
LINE INPUT : Above 70 mV
Impedance ..... 122 K ohms
DIN INPUT : 14 mV 122 K ohms

OUTPUT
LINE OUTPUT : Required Load Impedance : more than 50,000 ohms 1.23 V (+4 dBs ±1.5 dB) at 7-1/2 ips.
POWER OUTPUT
(at External Speaker Jack)
: More than 10 Watts r.m.s.

FAST FORWARD AND REWIND TIME
: 85 Seconds for a full 1,200 feet tape at 50 Hz
70 Seconds for a full 1,200 feet tape at 60 Hz

CROSS-TALK : Less than –70 dB (Monaural)
: Less than –43 dB (Stereo)

ERASE RATIO : More than 70 dB

INSULATION DURABILITY
: 500 V AC for more than one minute duration.

BIAS PREQUENCY : 93 ± 7 kHz

MAIN MOTOR : Hysteresis Synchronous 3 speeds (2-4-8 pole) motor
Power Condenser 3 μF (50 Hz), 2 μF (60 Hz)

Revolutions : 3,000–1,500–750 rpm (50 Hz)
3,600–1,800–900 rpm (60 Hz)

REEL MOTER : Two 6-pole eddy current outer-rotor motors

Revolutions : 930 r.p.m. at 50 Hz 100 V
1,120 r.p.m. at 60 Hz 120 V

HEADS

Playback Head : In-line 4 Track Stereo and Monaural
Impedance ....1,200 ohms at 1,000 Hz
Gap ..... 2 microns

Recording Head : In-line 4 Track stereo and monaural
Impedance ..... 135 ohms at 1,000 Hz
Gap ..... 4 microns

Erase Head : In-line 4-track Stereo and Monaural.
Impedance .....750 ohms at 90 kHz
Gap .....0.2 mm

Cross-Field Bias Head
: In-line 4-track Stereo and Monaural.
Impedance .....750 ohms at 90 kHz
Gap .....0.2 mm

INTERNAL SPEAKERS
: Two 4" x 6" oval type speakers

TRANSISTORS USED

6	2SC650 (A)/(B)	X-330D
2	2SC458 LG (B)	(without Main
2	2SC458 (B)	Amplidier)
6	2SC218 (B)	19 ea
2	2SC968	
1	2SD24	
2	23C372 (Y)	Main
2	2SC367 (O)	Amplifier
4	2SC490 (Y) (BL)	8 ea

Diodes Used : 18 10D2
1 10D1
5 1N34

II. MEASURING METHOD

TAPE SPEED DEVIATION

1. Method involving use of pre-recorded tape.

For measuring the tape speed deviation, play back the pre-recorded tape at 1,000 Hz ± 0.1%. Connect the appropriate output to a frequency counter meter in order to measure the tape speed deviation from the resulting deviation of the measured frequency.

2. Method involving-use of timing tape. (designed for tape speed measurement)

This method utilizes a timing tape marked at intervals of 7-1/2". The running time of over 60 marked sections of tape is measured in order to calculate the deviation of the tape speed. In applying this method, however, it should be kept in mind that the timing tape stretch or contract measurement error is inevitable, so that it is necessary to measure the total length of the tape in advance.

WOW AND FLUTTER

Playback the 3,000 Hz pre-recorded tape of which the wow and flutter level is guaranteed to be smaller than 0.07% for measurement by means of a wow meter. It is also possible for a 3,000 Hz sine wave to be recorded and played for measurement by means of the wow meter. In this case, however, the wow meter indicates a value as much as twice the value given in the specifications on he first page.

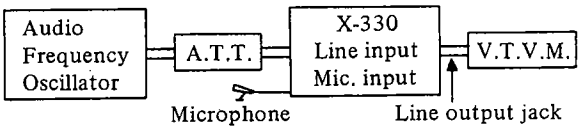
FREQUENCY RESPONSE

RECORD :

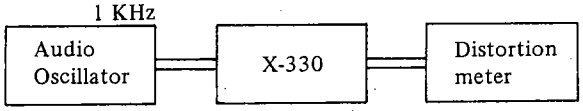
1) Give a sine wave of 1,000 Hz to the Line Input of the recorder to be tested through an attenuator from an audio frequency generator.
2) Set the "Mode Selector" to "Source" position and adjust the line input volume so that the VU meter needle indicates "0" VU.
3) Under the condition described in (2), lower the input level 20 dB by means of the attenuator.
4) Connect a microphone to the Microphone Input. Set the tape speed selector to 7-1/2" position.
5) Start recording. Control the microphone input level and the spot frequency in the range of 30 Hz to 25,000 Hz from the audio frequency generator and record by talking.
   * Remarks : After announcing the frequency of each point, the microphone volume should immediately be rotated back to minimum.

PLAYBACK :

6) Set the "Mode Selector" to "Tape" position and depress "Forward Button".
7) Set the Tape Speed Selector to 7-1/2" position.
8) Connect a Vacuum Tube Volt Meter to the line output jack (V.T.V.M. with milli volt scale).
9) Playback the recorded tape.
10) Playback the recorded spot frequencies and make a memo of output level and plot the value on a graph.



TOTAL HARMONIC DISTORTION FACTOR



Connect the measuring instrument as shown above, and record the 1,000 Hz sine wave at "0" VU. Playback the resultant signal and measure the overall distortion factor. Measure the noise level of the tape recorder with the tape removed ; connect the audio oscillator directly to the distortion meter for measurement of the distortion factor of the oscillator.

The required distortion factor may be obtained from the results of the above measurement by the following formula :

$$d_0 = d - d_1 - d_2$$

where, d_0 = Required
d = Overall distortion factor
d_1 = Noise level
d_2 = Distortion factor of the oscillator

(Note : New tape of particularly good quality should be used for measurement of the distortion factor).

SIGNAL TO NOISE RATIO

Set the tone Switch on "Flat" position and Playback a tape containing a 250 Hz sine wave recorded at "O" VU level on a standard recorder. Connect a high sensitivity V.T.V.M. to the line output jack and measure its output. Then remove the tape and measure the noise level under the same conditions. Convert into decibels each of the measured values.

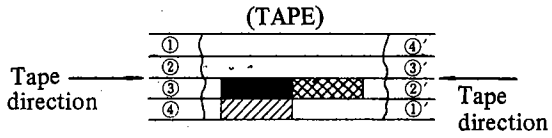
POWER OUTPUT

Playback a tape containing a sine wave of 1,000 Hz recorded at "O" VU. Connect an 8 ohm load resistor to output terminal and measure the voltage at the output of the recorder.

$$P = \frac{E^2}{R}$$

P = Desired output (watts)
E = Measured voltage (R.M.S.)
R = 8

CROSS TALK (Cross talk between the tracks)



As shown in the above figure, first record a 1,000 Hz sine wave on track No. 3 at +3 VU level. Next, remove the 1,000 Hz input signal and record under a non-input condition. Then, playback the tape on track No. 3 and No. 1 (reversed condition of tape) through the 1,000 Hz B.P.F. (Band Pass Filter, Sensitivity . . . 1 : 1) and obtain a ratio between the two from the following formula.

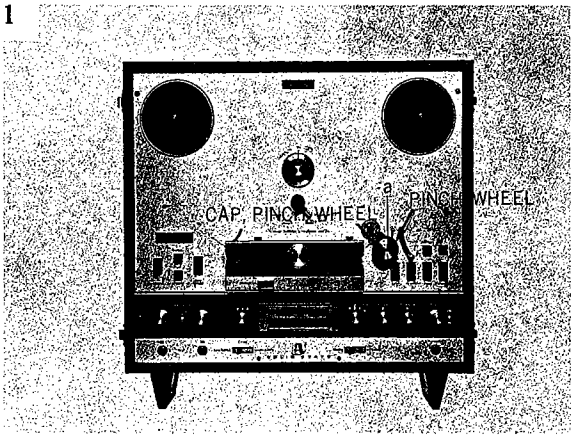
$$C = 20 \log \frac{E_0}{E_2 - E_1} \text{ (db)}$$

C = Desired cross talk ratio (db)
E_0 = 1,000 Hz signal output level
E_2 = 1,000 Hz cross talk output level
E_1 = Non-input signal record level

IV. DISMANTLING OF TAPE TRANSPORT UNIT & AMPLIFIERS

In case of trouble, etc. necessitating disassembly, please disassemble in the order shown in photographs. Remantle in reverse order.

1



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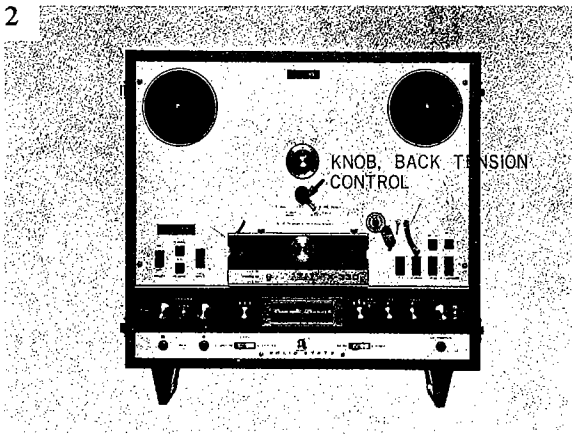

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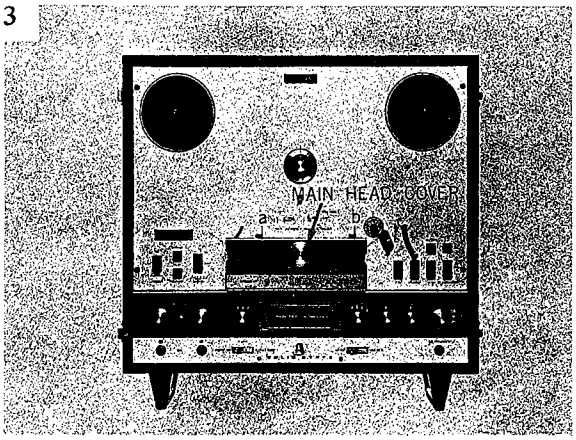

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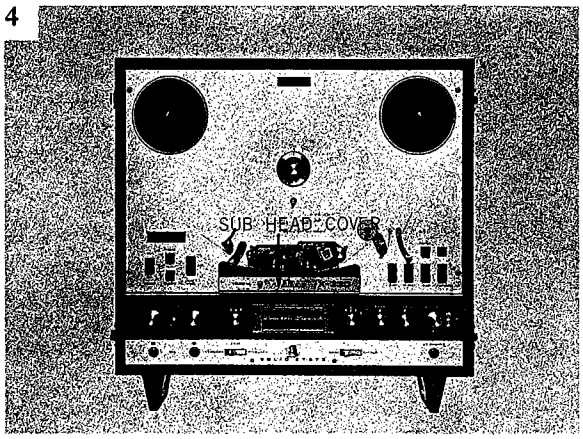

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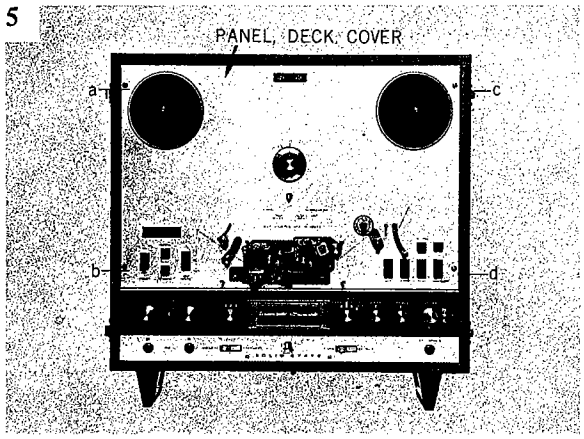

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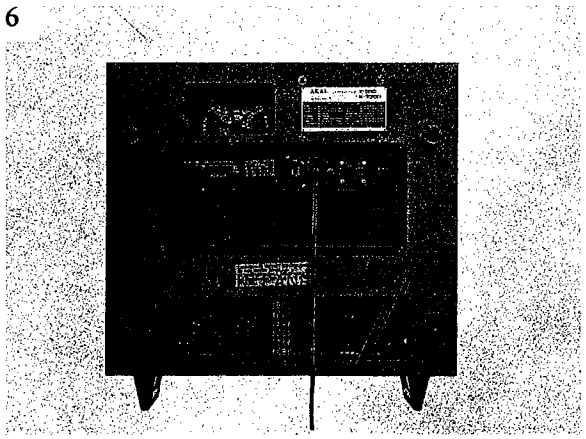
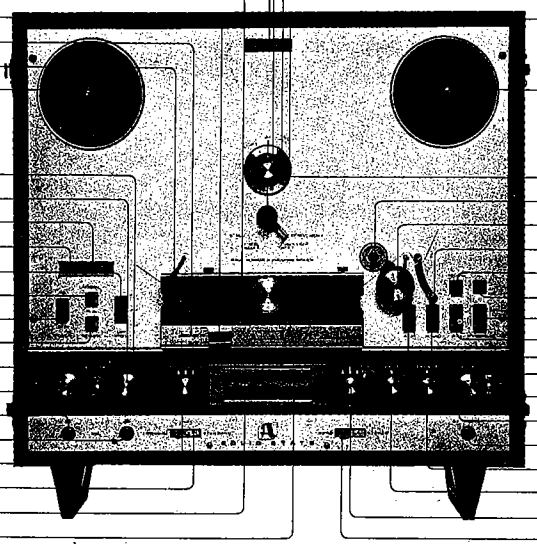
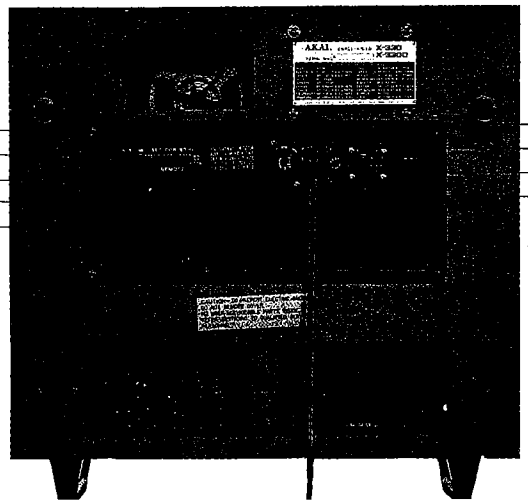
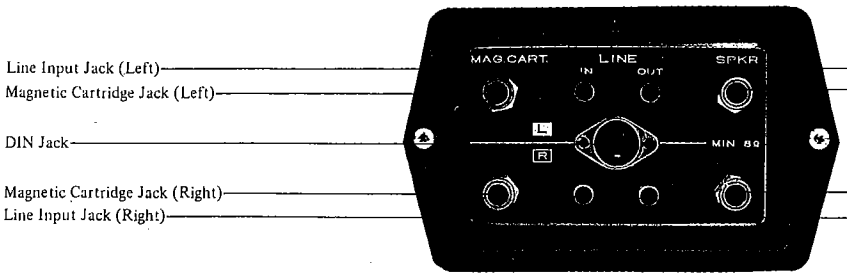


III. CONTROL LOCATIONS







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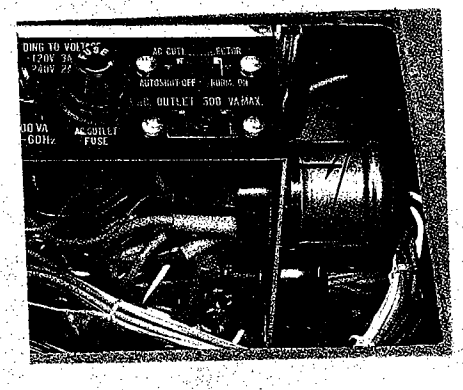

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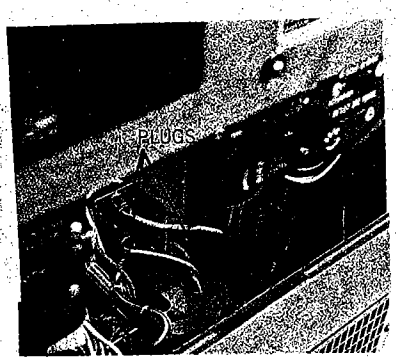
PLUGS

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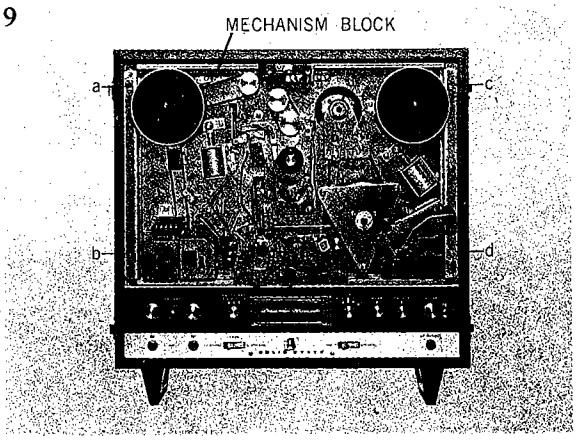
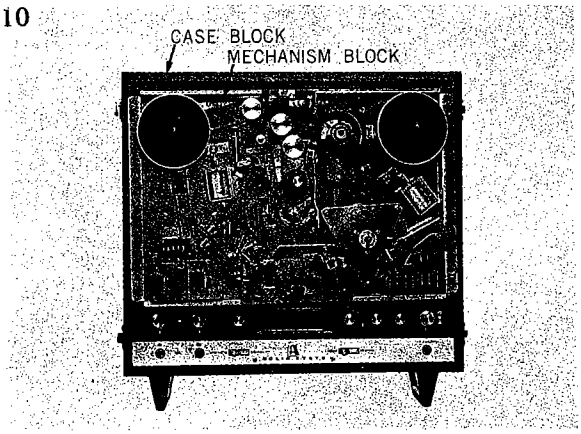
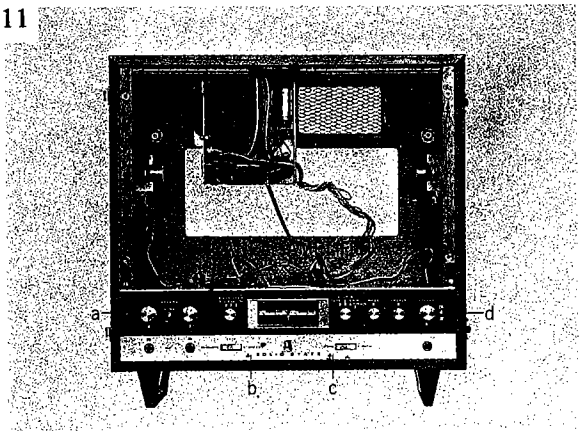

MECHANISM BLOCK
a
b
c
d

10


CASE BLOCK
MECHANISM BLOCK

11


a
b
c
d

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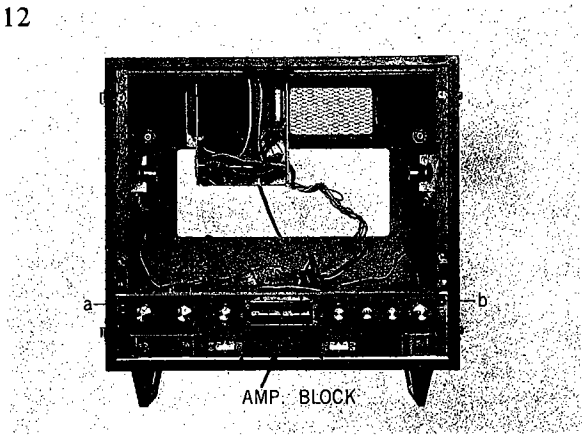
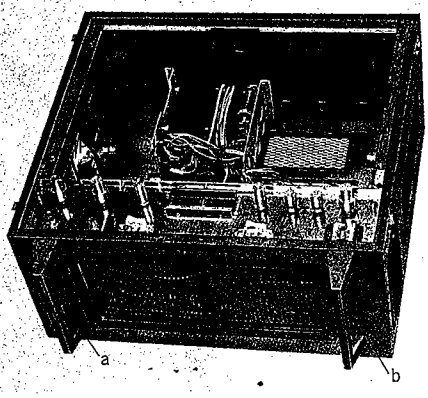

a
b
AMP BLOCK

13



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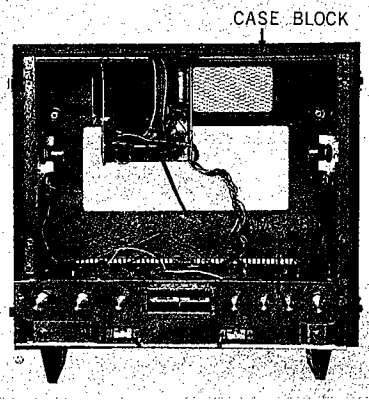

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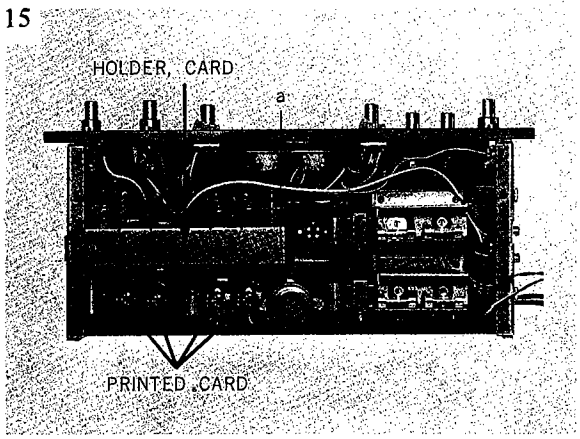

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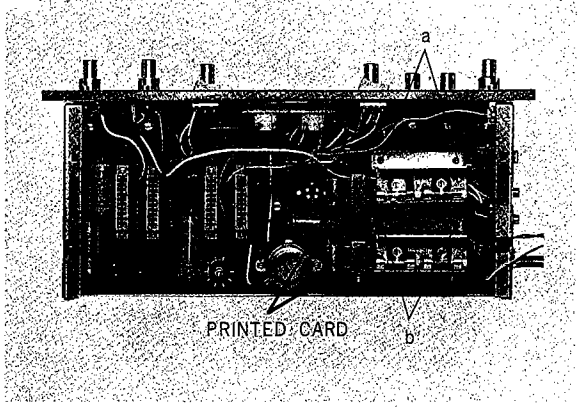

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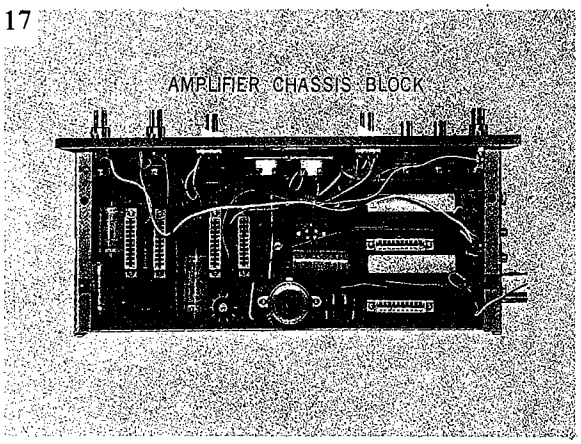

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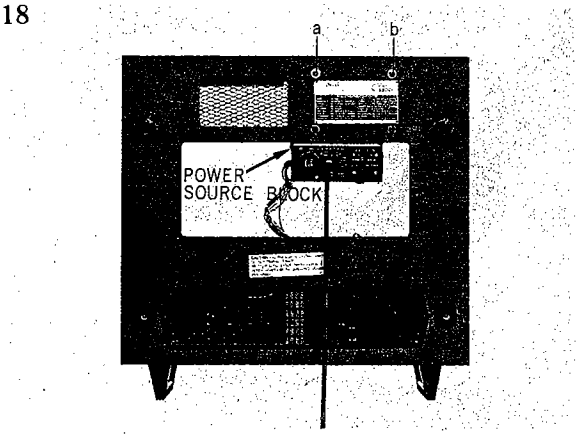

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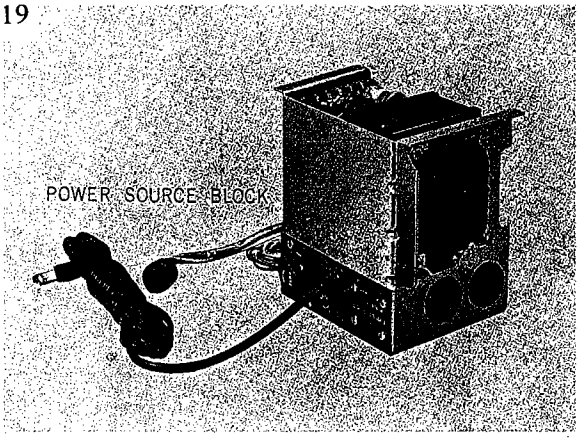


V. TRANSPORT MECHANISM

1. OPERATING MECHANISM PRINCIPLE

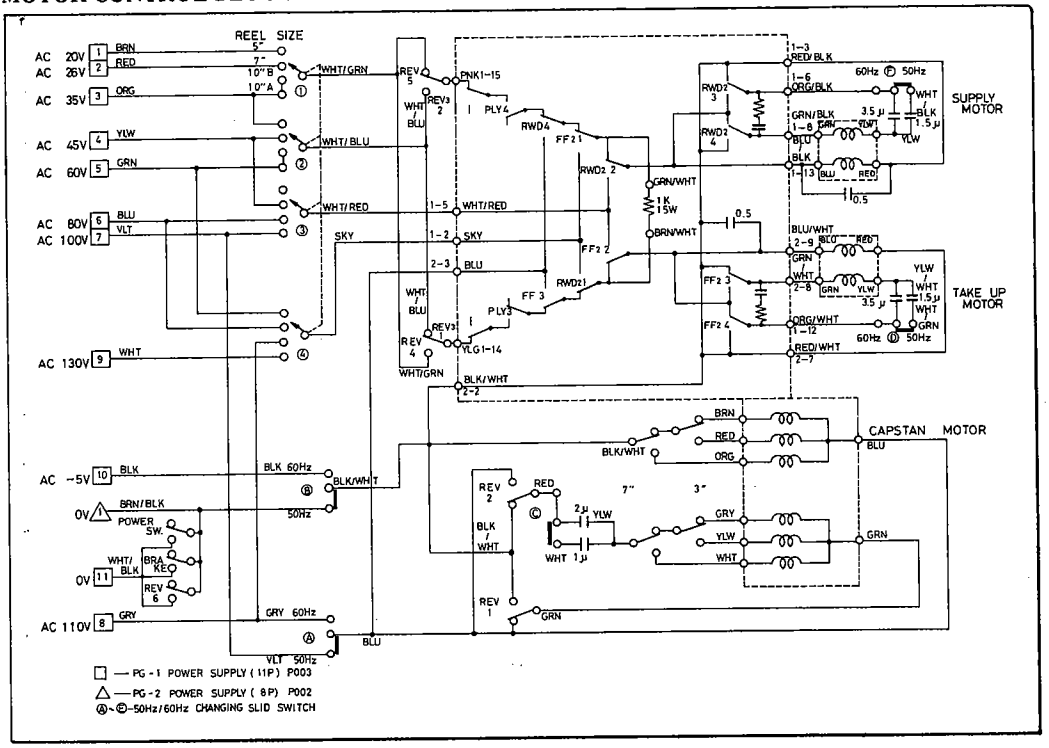
Operating priciples of Mechanism System Control and Motor Control Circuit is outlined in Block Diagram 1 and 2.

At Playback and Reverse Mode, voltage to supply reel motor and take-up reel motor is as shown in chart 1.

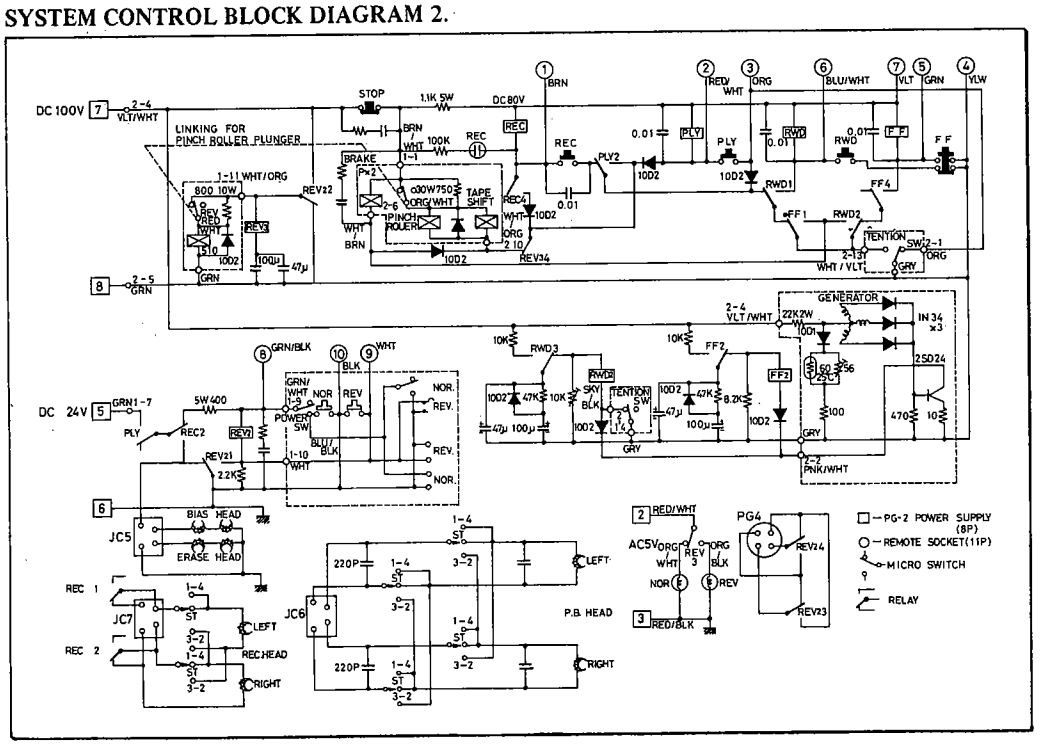
Back Tension Control	Mode	Supply Reel motor	Take-up Reel motor
10" Reel Heavy & Light	Normal	35 V	60 V
	Reverse	60 V	35 V
7" Reel	Normal	26 V	45 V
	Reverse	45 V	26 V
5" Reel	Normal	20 V	35 V
	Reverse	35 V	20 V

CHART 1.

MOTOR CONTROL BLOCK DIAGRAM 1.



SYSTEM CONTROL BLOCK DIAGRAM 2.



2. MAGNETIC BRAKE OPERATING MECHANISM

When Back Tension Switch is set to 10-1/2" Reel Heavy position and Stop button is depressed during Fast Forward mode, the following is an explanation of the Operating Principle of Magnetic Brake function :

Fig. 1 is the Magnetic Brake Control Circuit Block Diagram. At Fast Forward (hereinafter referred to as "FF"), FF Relay is energized and condenser 47 μF is charged.

If FF time is short, Condenser 47 μF only is being charged. If FF time is lengthy, through 47 KΩ resistance, 100 μF is also being charged.

If Stop button is depressed during FF operation, FF Relay FF2 contact is released to "stop" position. Condenser 47 μF and 100 μF discharge current passes through FF2 Relay and Transistor 2SD24.

The base of Transistor 2SD24 is connected to the Tach Generator.

DC Voltage is supplied to the center of Tach Generator Coil and the Tach Generator is driven by the take-up reel motor.

Correspondingly, during Take-up Motor revolutions, Transistor 2SD24 is being conducted. While 2SD24 is being conducted, FF2 Relay mechanism is continuously energizing.

Voltage to supply motor is 16 V and voltage to Take-up motor is 100 V (as is shown in Fig. 2) at fast forward.

If FF2 Relay is energized, a reverse voltage of 130 V is supplied to supply motor and a reverse voltage of 100 V is supplied to take-up motor and magnetic brake operates. Tape is stopped by operation of magnetic brake.

When take-up motor is stopped, there is no Tach Generator output and FF Relay is "off". The Voltage to both motors is nil.

If Stop button is depressed during rewind operation, The magnetic brake works on the same principle as previously described except that at Rewind Mode, in case the tape has been completely rewound, the take-up motor stops within a short time. Therefore, the Tach Generator is also stopped, so that by means of the Tension Switch, RWD2 Relay is energized and causes the magnetic brake to work.

When Back Tension Control Switch is switched to 10-1/2" Reel Heavy, 10-1/2" Reel Light, 7" Reel, and 5" reel positions, when the magnetic brake is operating, the voltage to both reel motors is as shown on chart 2.

Back Tension Control	Mode	Supply Reel motor	Take-up Reel motor
10"Reel Heavy	F.F. FF2 Magnetic brake	16 V 130 V	100 V 100 V
10"Reel Light	F.F. FF2 Magnetic brake	16 V 110 V	100 V 80 V
7" Reel	F.F. FF2 Magnetic brake	16 V 60 V	100 V 35 V
5" Reel	F.F. FF2 Magnetic brake	16 V 45 V	100 V 0 V

CHART 2.

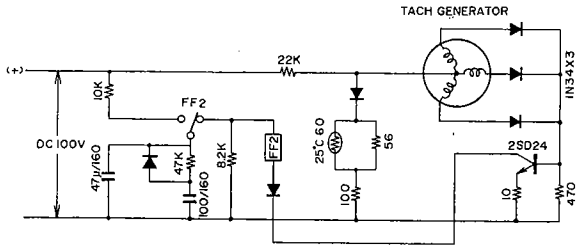


Fig. 1

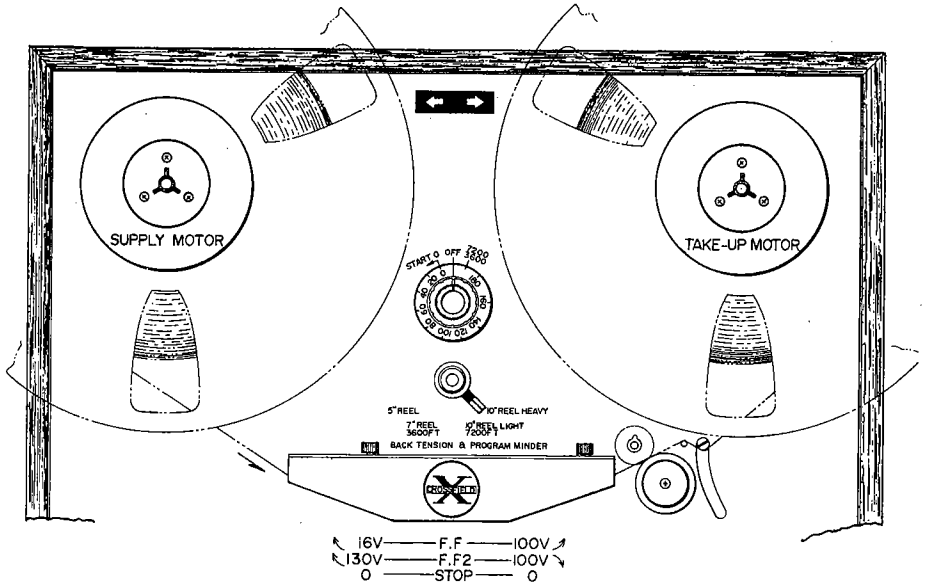


Fig. 2

VI. MECHANISM ADJUSTMENT

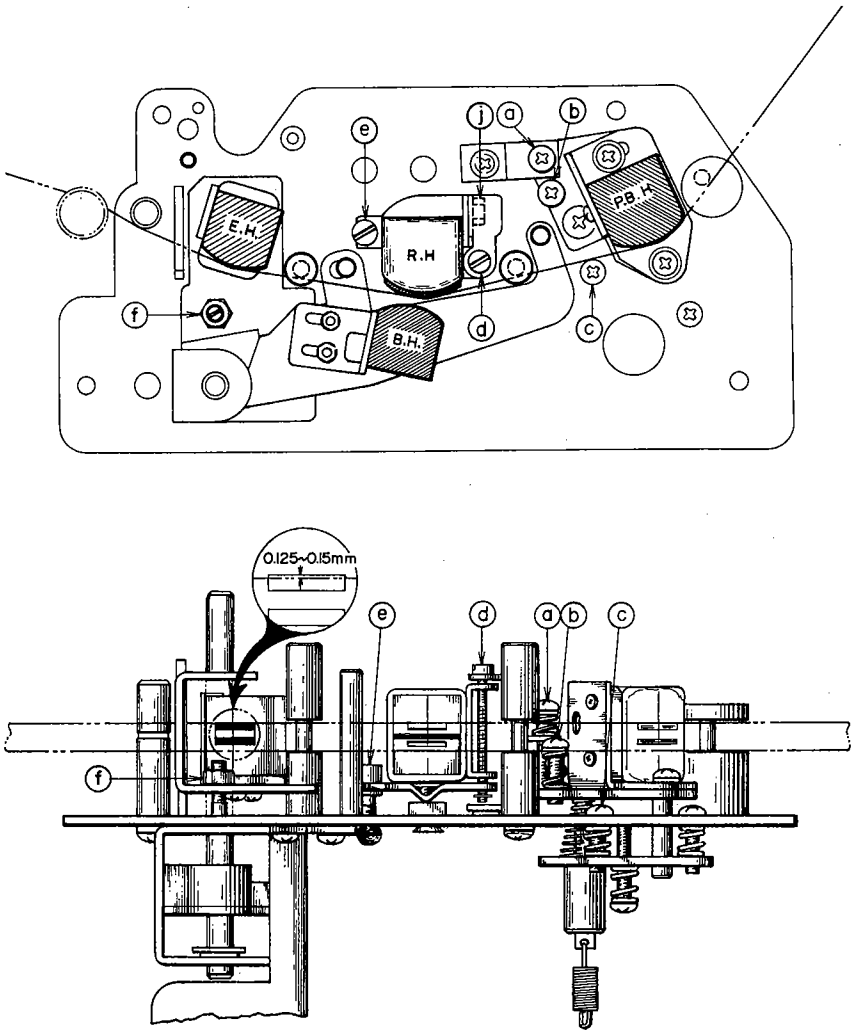


Fig. 1

1. ADJUSTMENT OF MAGNETIC HEADS

1) Adjustment of Head Height

(1) Playback Head

While in normal Playback Mode, with Screw (a) (Fig. 1), align playback head core and tape so that the top edge of the tape runs exactly parallel with the top edge of the playback head's upper core.

In Reverse Play Mode, with Screw (b), align playback head core and tape so that the bottom edge of the tape runs exactly parallel with the bottom edge of the playback head's lower core.

(2) Recording Head

Loosen Screw (j) and with Screw (d), align recording head core and tape so that the top edge of the tape runs exactly parellel with the upper edge of the recording head's upper core.

(3) Erase and Bias Head

Loosen the Lock Nut of Screw (f) and with Screw (f), adjust the upper core of the erase head and the tape so that the tape runs within 0.125 mm to 0.15 mm below the edge of the erase head's upper core (top edge of core should be 0.125 ~ 0.15 mm higher than the top edge of the tape).

2) Adjustment of Azimuth Alignment

(1) Playback Head

Connect a High Sensitive V.T.V.M. to Line Output Jack. While playing back a 16 kHz 8-1/2 ips pre-recorded tape, adjust Screw (c) so that the V.T.V.M. indicator is at maximum. (In normal and reverse play, check to confirm that the output error is small).

(2) Recording Head

Connect an Audio Oscillator to the Line Input. At −16 dB (16 below "0" VU), record a 16 kHz signal. Connect a High Sensitive V.T.V.M. to the Line Output. Set Mode Selector to "Tape" position. Adjust Screw (e) so that the V.T.V.M. indicator is at maximum.

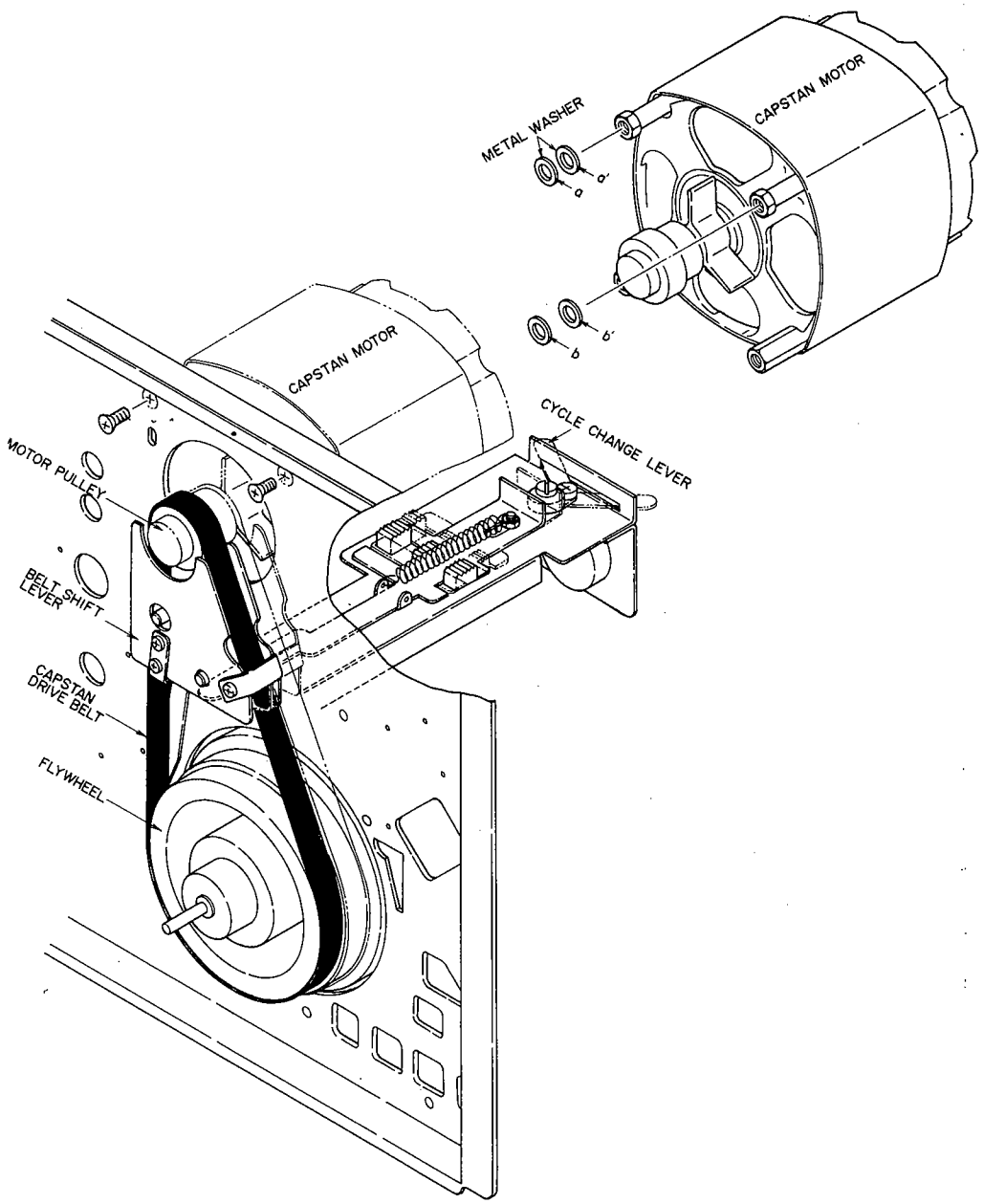


Fig. 2

2. ALIGNMENT OF CAPSTAN DRIVE MECHANISM

When the Cycle Change Switch Lever is changed to 50 or 60 Cycles, this moves the operating position of the Capstan Drive Belt. (At 50 cycles, the belt is moved to the more exterior belt guide ; at 60 cycles, it is moved to the more interior belt guide).

1) The Capstan Drive Belt is positioned to run in the center of the Flywheel as well as the Motor Pulley, and must not contact the Belt Shift Lever.
2) To adjust operating position of Drive Belt, place Metal Washers (a) (a') and (b) (b') between the Motor Mount Prop and Chassis.
3) Use Metal Washers on only the two upper Motor Mount Props (Fig. 2).

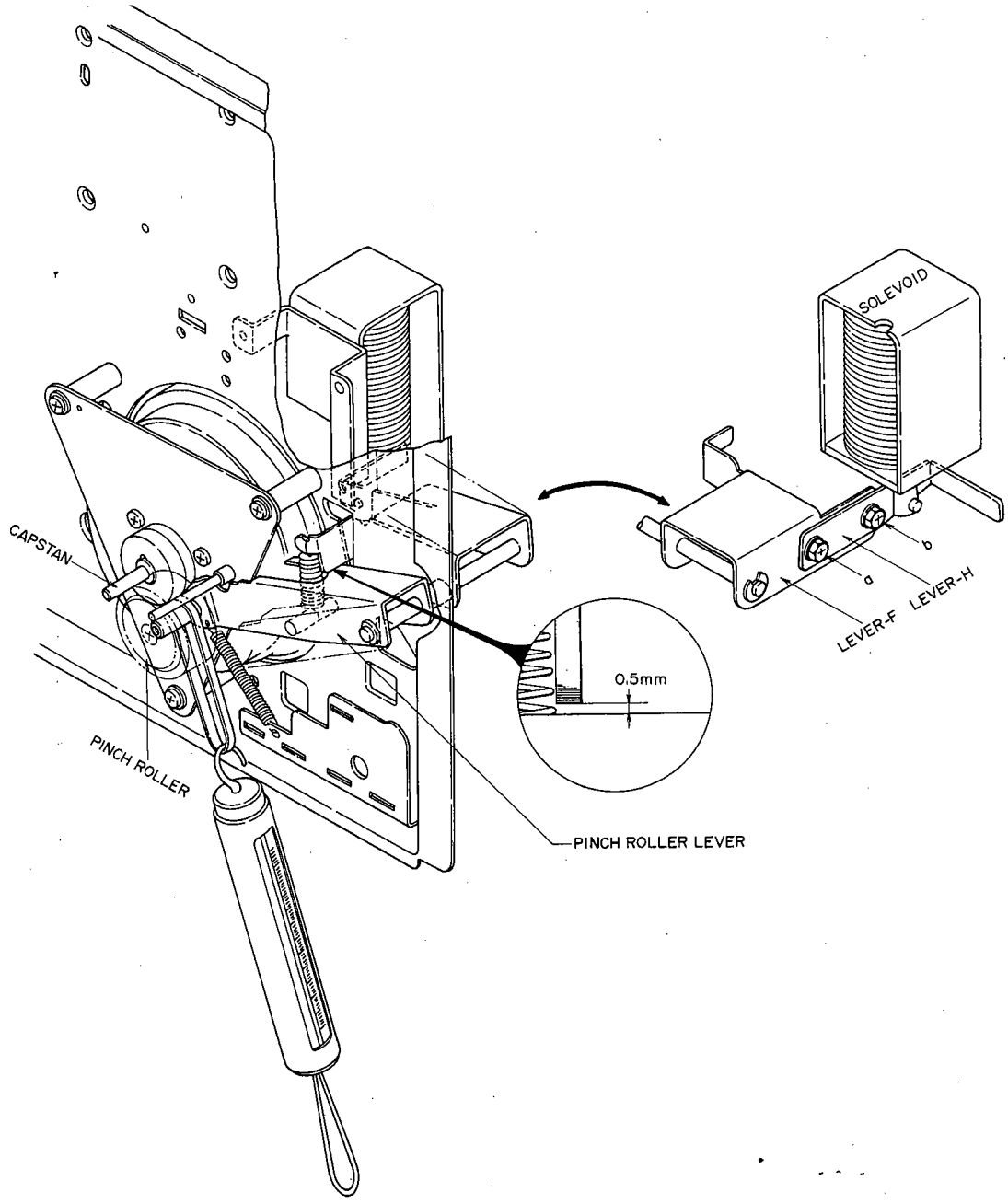
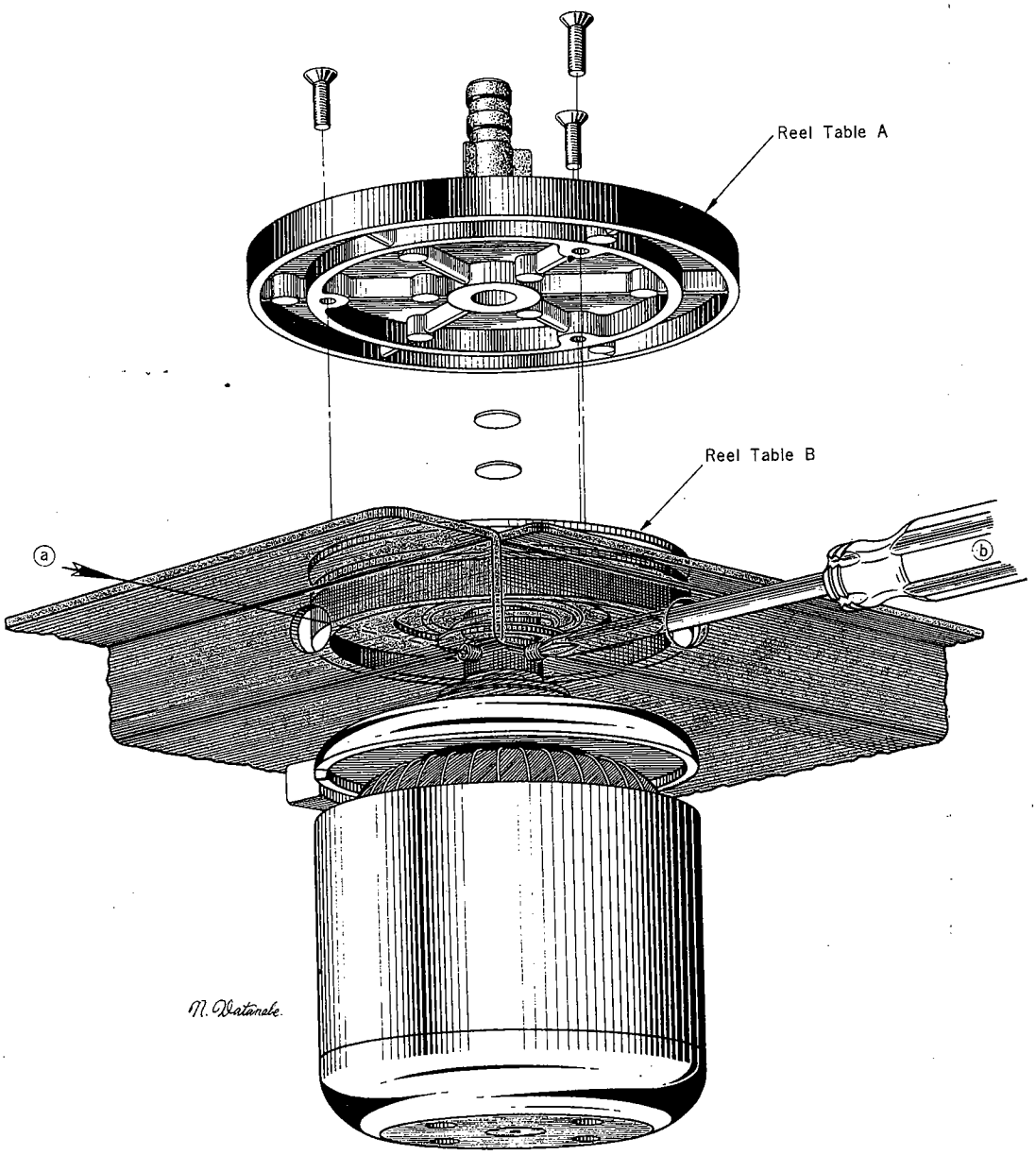


Fig. 3

3. ADJUSTMENT OF PINCH ROLLER PRESSURE

1) With Pinch Roller Solenoid energized, adjust screw (a) and (b) so that there is a space of approximately 0.5 mm between Lever (f) and the Pinch Roller Lever.
2) As shown in Fig. 3, using a Tension Gauge, during pinch roller revolutions, check to see whether the scale on the tension gauge stops at 1.7 K grams (±200 grams).
3) In case tension is not standard, loosen screws (a) and (b) and re-adjust the space between Lever (f) and the Pinch Roller Lever.



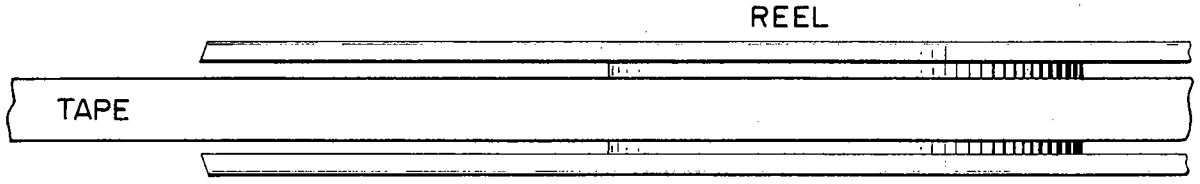


Fig. 4

4. ADJUSTMENT OF REEL TABLE HEIGHT

1) As shown in Fig. 4, insert screw driver through the holes in the chassis and loosen Screws (a) and (b).
2) By hand, align the position of the reel table with the center of the tape reel.
   Tighten screws (a) and (b).

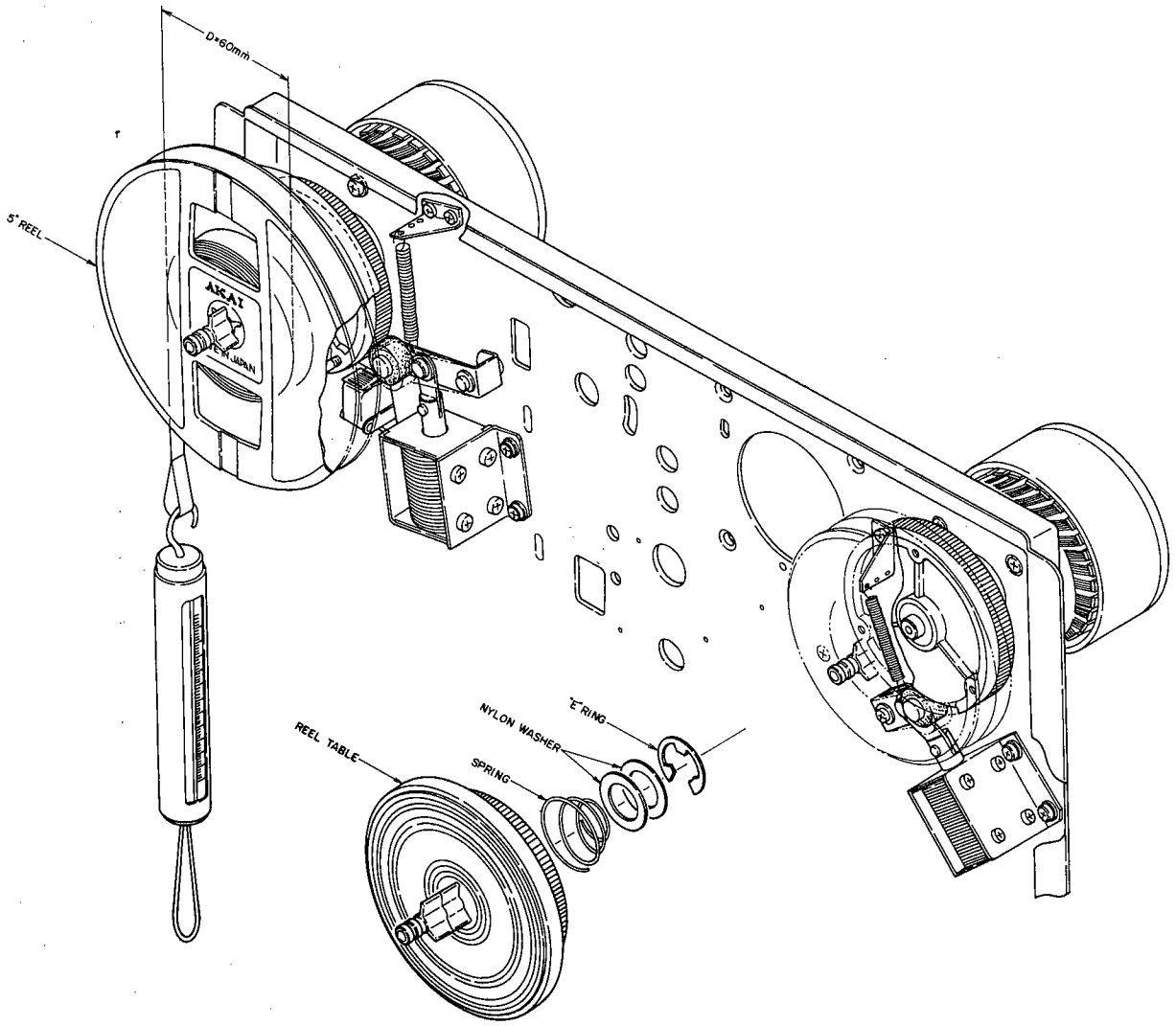


Fig. 5

5. ADJUSTMENT OF BRAKE TENSION

1) Standard Brake Tension is 250 grams (±20 grams).
2) In case Brake Tension adjustment is necessary, adjust tension by increasing or decreasing the number of nylon washers (Fig. 5).

6. MAGNETIC BRAKE ADJUSTMENT

For magnetic brake adjustment, set Back Tension Control Switch to 10-1/2" Reel Heavy position. At an increased voltage of 20% (for example supply 120 V for a machine which is set at 100 V), set a 10-1/2" Tape.
In case of depressing Stop button during fast forward mode, adjust potentiometer R-503 (100 Ω) so that the take-up reel does not rotate in opposite direction.

VII. AMPLIFIER ADJUSTMENT

1. PLAYBACK PRE-AMPLIFIER OUTPUT LEVEL ADJUSTMENT.

(a) Connect High Sensitivity V.T.V.M. to Line Output jack.
(b) Set Tape Speed Selector Switch and Equalizer Switch to "7-1/2" position.
(c) Set Mode Selector to "Tape" position.
(d) Play back 250 Hz 0 VU pre-recorded tape.
(e) Adjust Playback Printed Board Potentiometer VR-201 (20 KB) so that the Line Output voltage indicates 1.23 V (+4 dBs).
At this time, VU Meter Needle should indicate "0" VU (between black and red marks).

2. MAIN AMPLIFIER ADJUSTMENT

(a) Connect collector circuit of main amplifier transistors TR-503 and TR-504 to Ammeter (100 mA to 150 mA scale) as shown in Fig. 1.
(b) Connect 8 Ω (20 W) resistor to External Speaker jack.
(c) Set Volume Controls to minimum position.
(d) Adjust potentiometer VR-501 or VR-502 so that Ammeter shows 40 mA.

Caution : At times when transistor TR-503 and TR-504 collector voltage is over 21 V and collector current is also more than 40 mA, adjust Potentiometer VR-501 and VR-502 so that TR-503 and TR-504 collector current is equal.

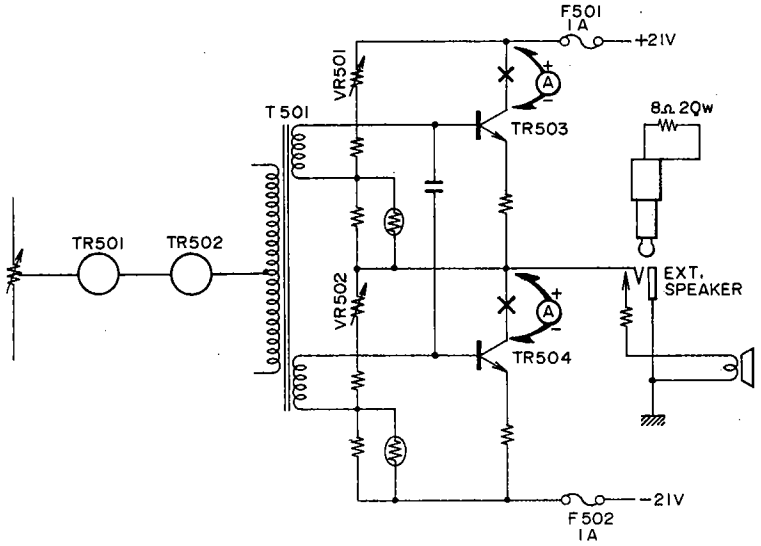


Fig. 1

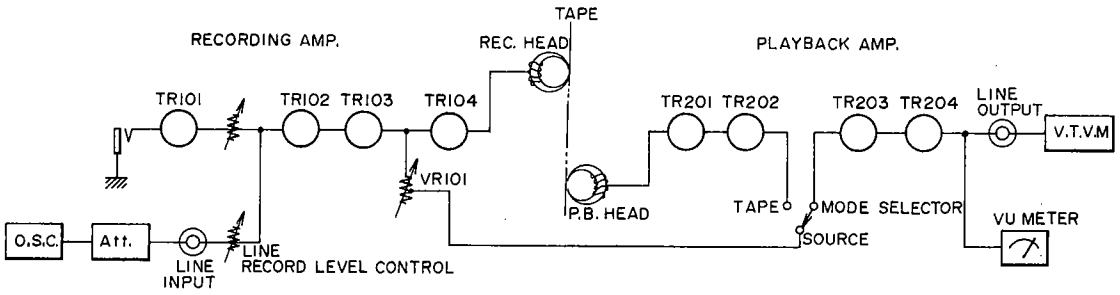


Fig. 2

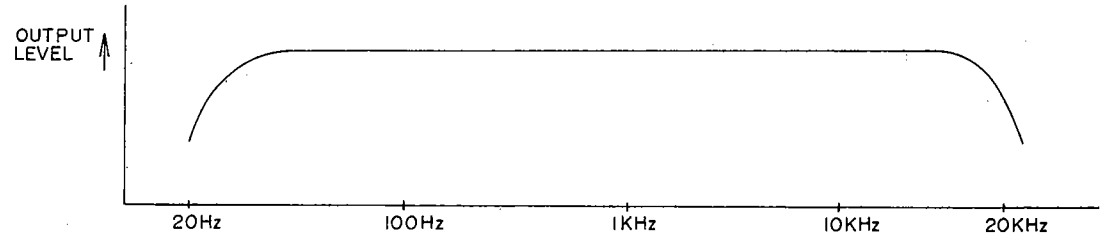


Fig. 3

3. RECORDING AMPLIFIER ADJUSTMENT

(a) Load a blank test tape on tape recorder.
(b) Connect Audio Oscillator and Attenuator to Line-Input as shown in Fig. 2.
(c) Connect High Sensitivity V.T.V.M. to Line-Output.
(d) Set Tape Speed Selector and Equalizer Switch to "7-1/2" position and set Mode Selector to "Tape" position.
(e) Supply a 1000 Hz signal from Audio Oscillator.
(f) Depress Record Interlock button and Play button to recording mode.
Adjust Line Record Level Control so that VU Meter Needle indicates "0" VU.
(g) Set Mode Selector to "Source" position. Adjust recording amplifier potentiometer VR-101 (2 KΩB) so that the VU Meter Needle indicates "0" VU.

4. RECORDING EQUALIZATION CHARACTERISTICS ADJUSTMENT

(a) For tape setting and meters, follow procedure used for adjustment of recording amplifier.
(b) Set Mode Selector to "Source" position.
(c) Supply 1000 Hz signal from Audio Oscillator. Set Line Record Level Control so that VU Meter needle indicates "0" VU.
(d) With Attenuator, attenuate signal level from audio Oscillator by 20 dB.
(e) Depress Record Interlock button and Play button to recording mode, and set Mode Selector to "Tape" position.
(f) At this point, continuously change oscillation frequency of audio oscillator and take V.T.V.M. reading of Line Output. Check frequency response curve as shown in Fig. 3.
(g) In case frequency response varies from specification, adjust gap between Recording and Bias heads until specification is met (as shown in Fig. 4).
(Gap A and B should be 0.2 mm to 0.5 mm respectively.)
(h) If the space between the Recording and Bias heads has to be changed, because the distortion level and recording level is also changed, adjust distortion level within 3% and frequency response to meet specification.
(i) Re-adjust recording level according to Recording Amplifier Adjustment procedure.

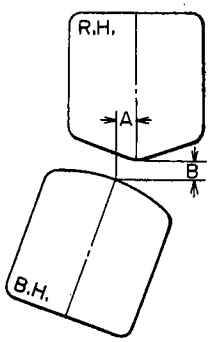


Fig. 4

VIII. MAINTENANCE PROCEDURES

1. LUBRICATION INSTRUCTIONS

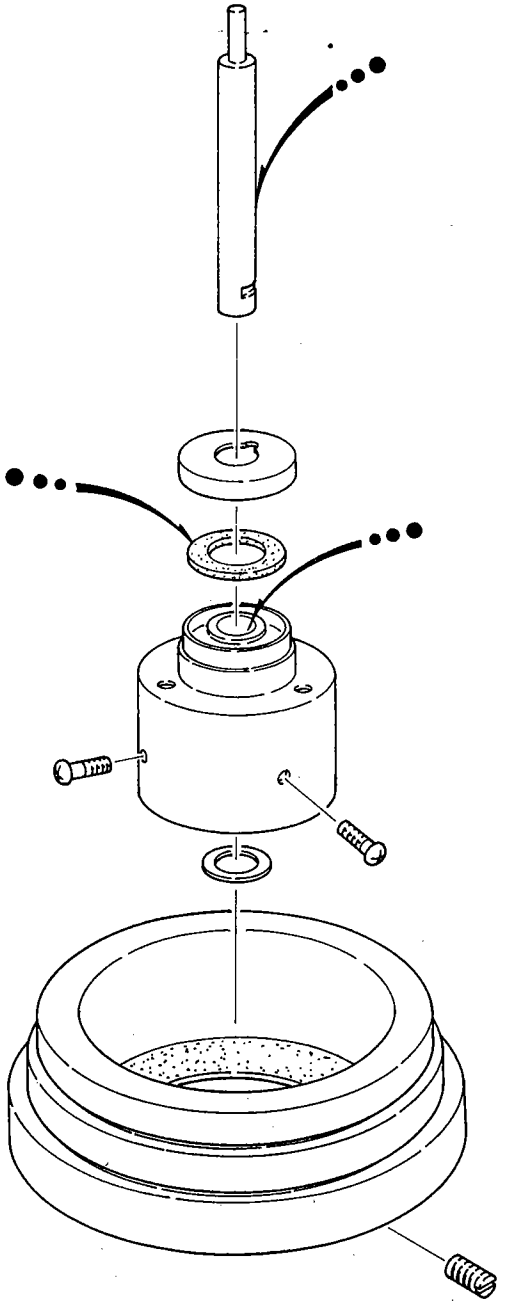
For maximum service life and optimum performance, lubricate the parts identified below after each 1,000 ~ 1,500 hours of operation. Use only light machine oil of good quality.

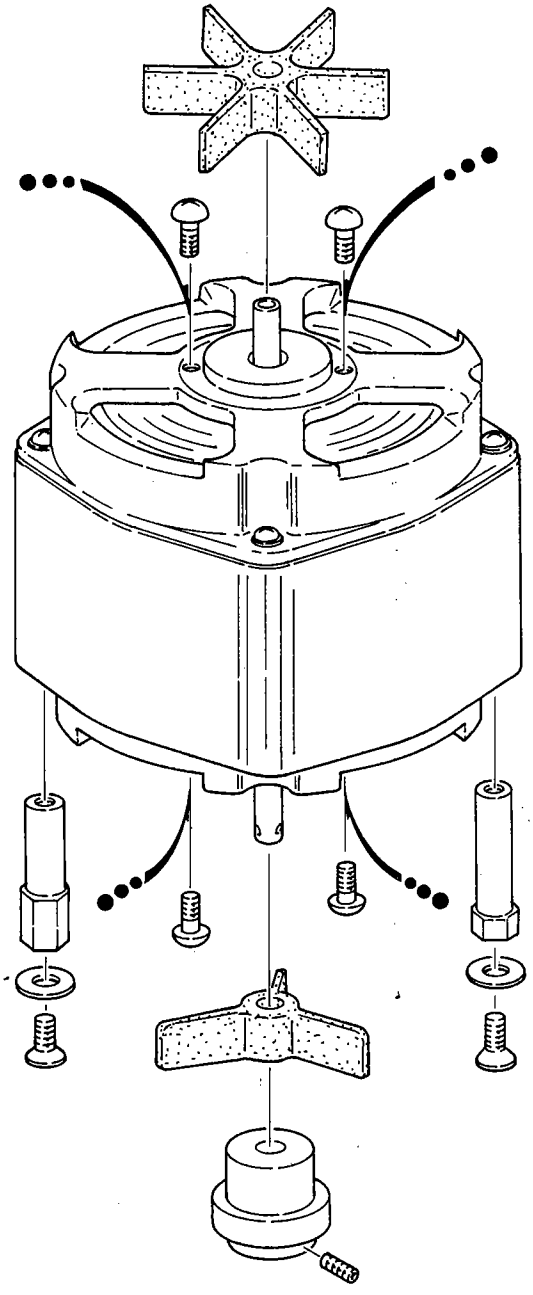
Main Motor
Capstan Shaft
Pinch Wheel Shaft
Tape Counter
Also apply a liberal film of light machine oil to each roller suface of all levers and cams.

CAUTION : DO NOT OVER-LUBRICATE, AND WIPE OFF EXCESS OIL WITH A COTTON SWAB SOAKED IN ALCOHOL. OTHERWISE, EXCESS LUBRICANT MAY BE SCATTERED DURING OPERATION. AND THE RUBBER COMPONENT PARTS WILL DETERIORATE.

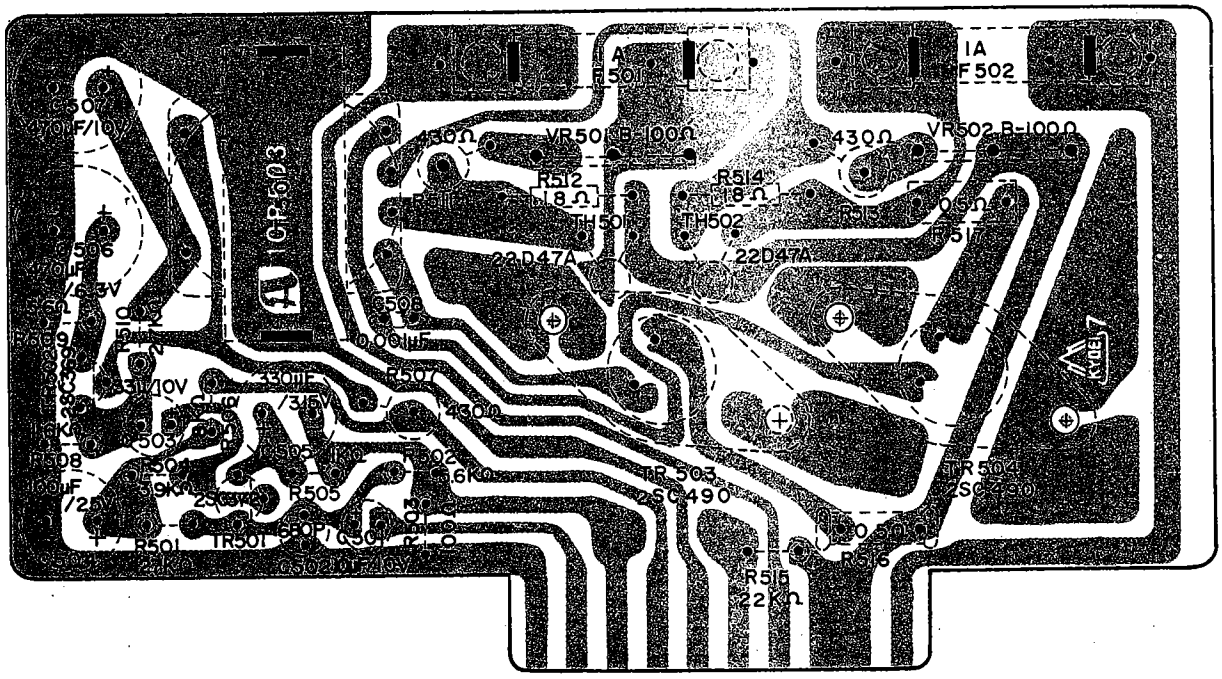
2. CLEANING TAPE HEADS, ETC.

Wipe surface of tape heads, guide roller bearing, capstan bushing and pinch wheel periodically with a soft cloth soaked in alcohol or carbon-tet.

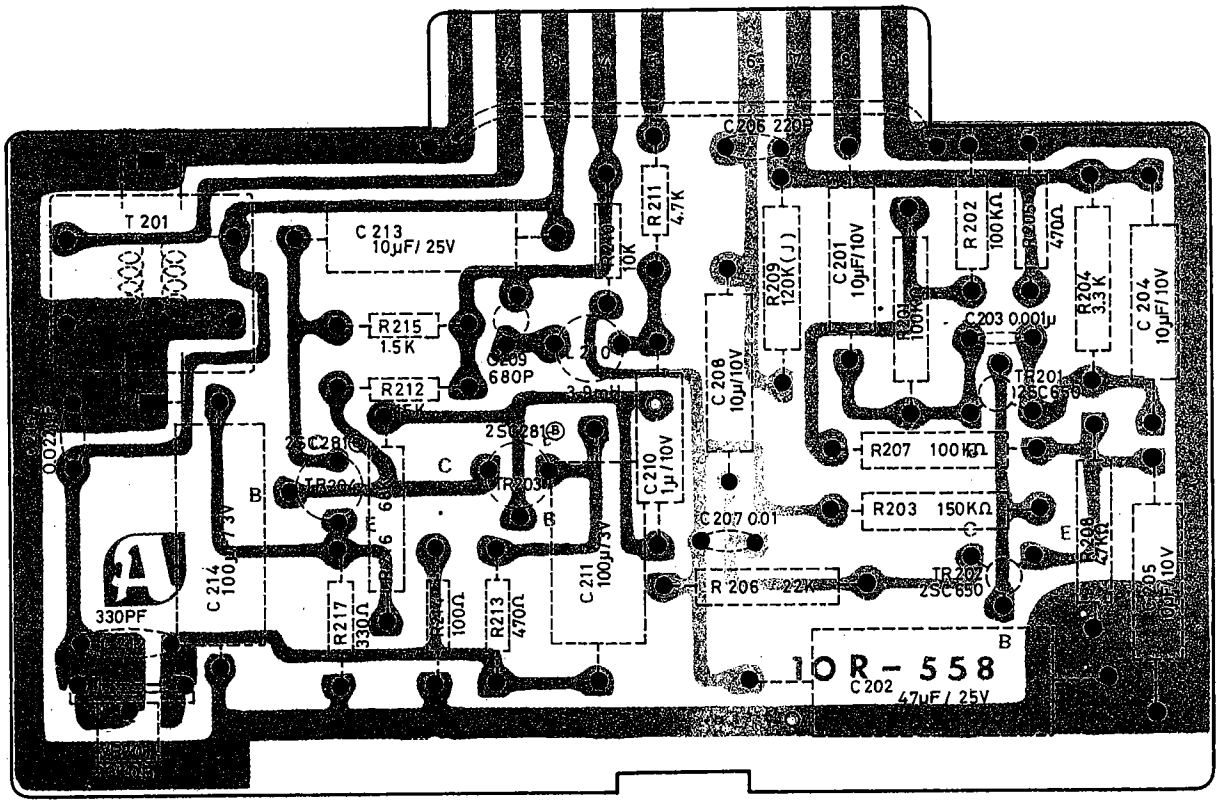




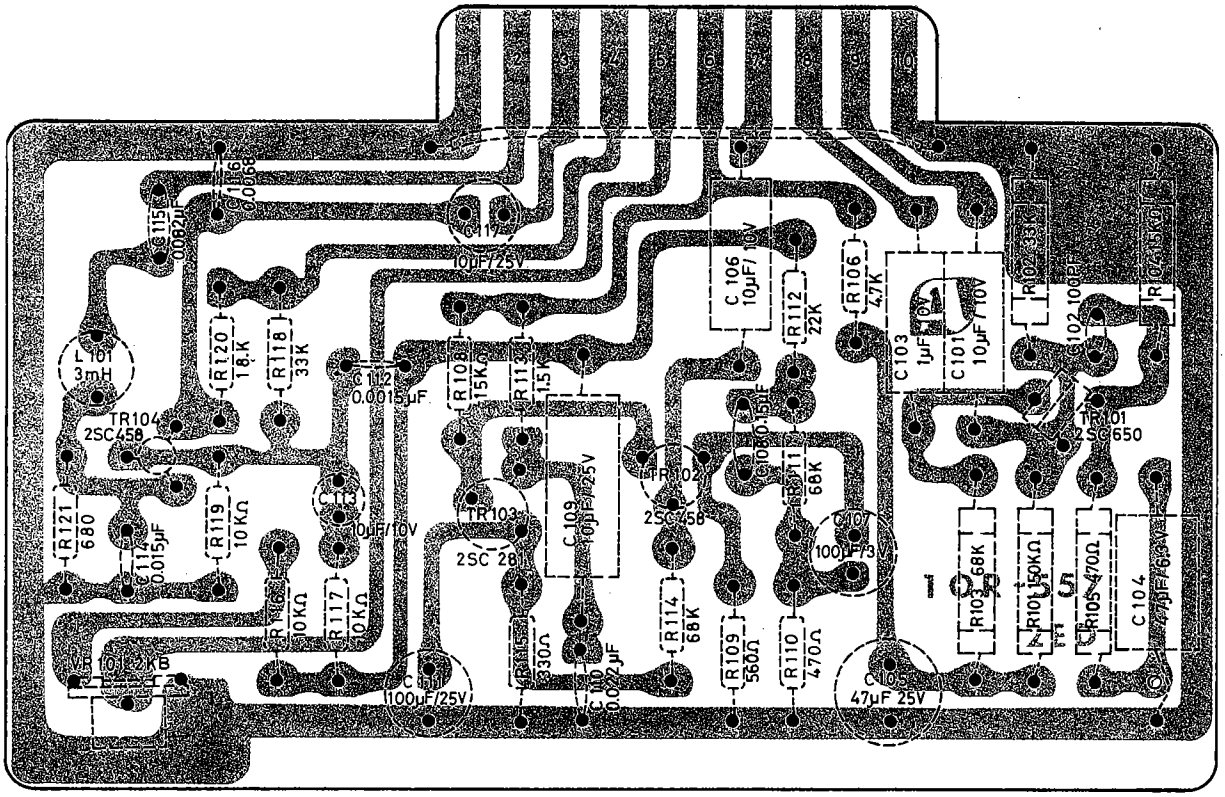
MAIN AMP. PRINTED CARD (10R-503)



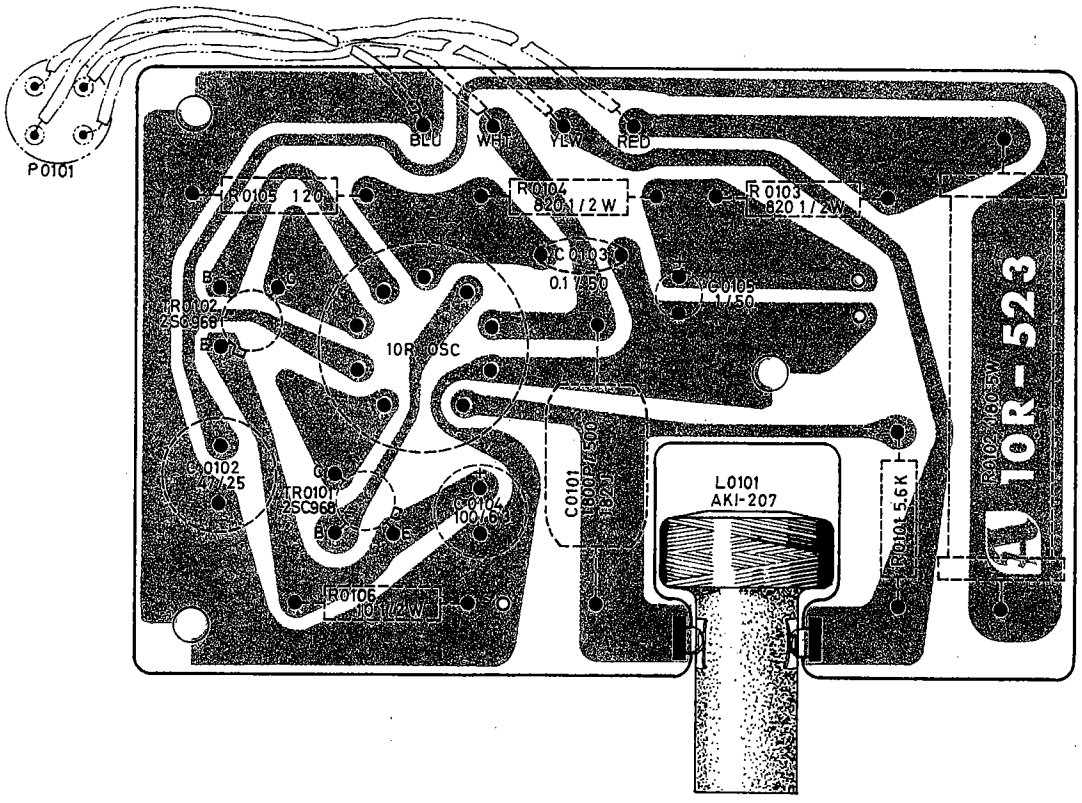
P.B. AMP. PRINTED CARD (10R-558)



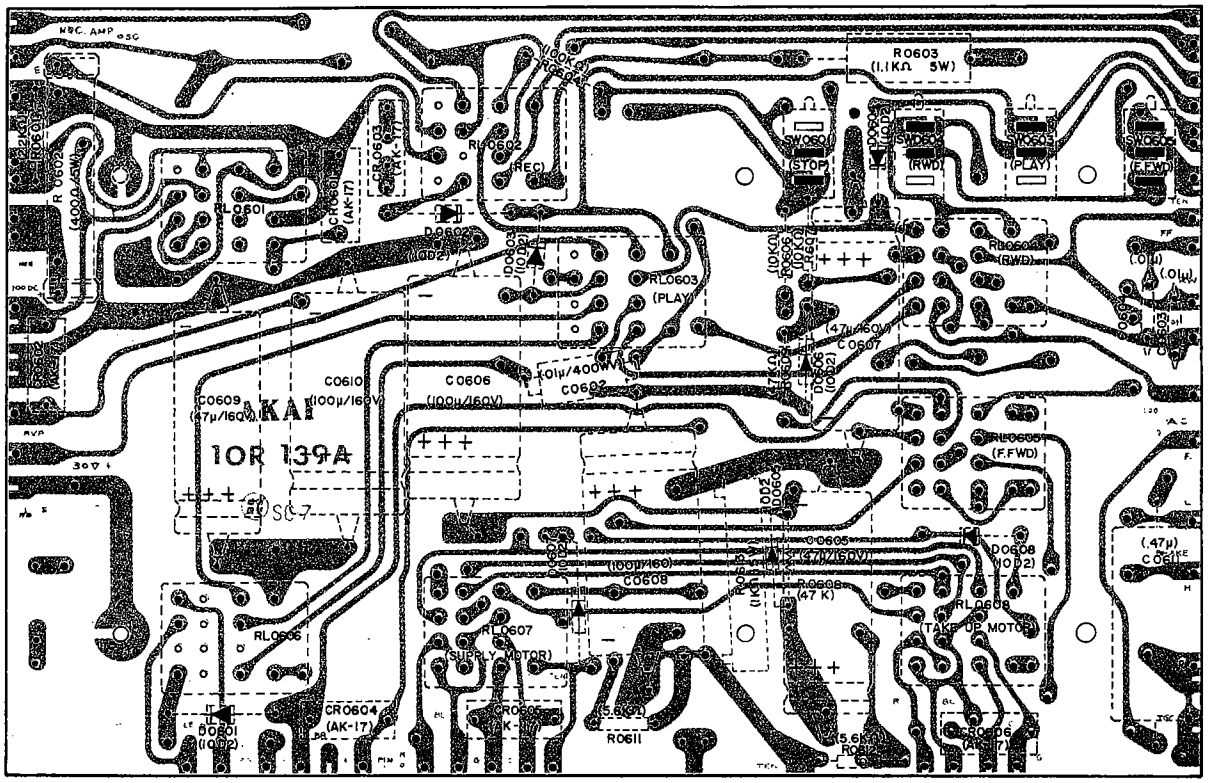
REC. AMP. PRINTED CARD (10R-557)

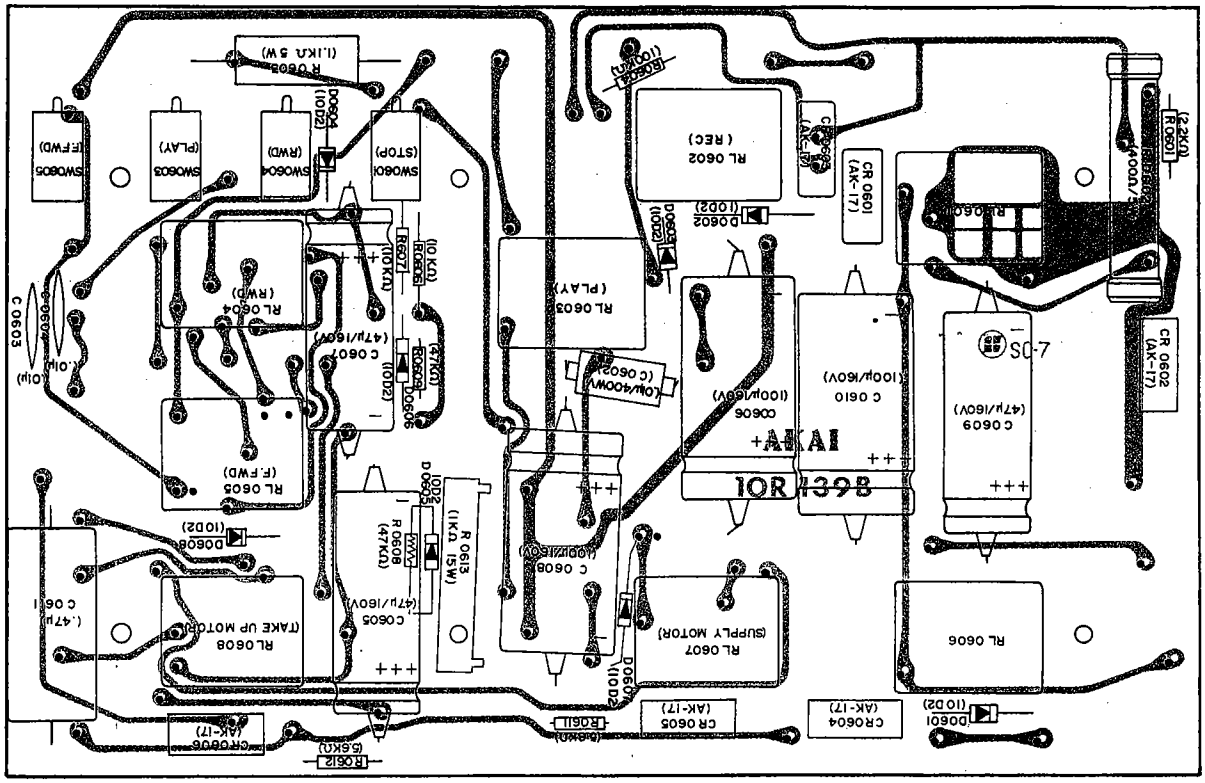


OSC. PRINTED CARD (10R-523)



SYSTEM CONTROL PRINTED CARD (10R-139)





X. TROUBLE SHOOTING CHART

SECTION "A" TROUBLES WITH TAPE TRANSPORT MECHANISM

1. Capstan does not Rotate

- Capstan motor does not rotate
  - Rotates when Speed Change Switch is re-positioned — Broken wire in motor coil — Replace motor
  - Does not rotate even when Speed Change Switch is re-positioned
    - Reverse Relay contact point defective — Replace Reverse Relay
    - Power Condenser defective — Replace
- Capstan motor rotates normally
  - Capstan drive belt has come off — Put back on
  - Fly wheel shaft has no oil — Oil

2. Tape does not Move at Playback Mode

- Pinch Roller not operating
  - Pinch Roller Solenoid defective — Replace
  - PLY Relay defective — Replace
- Reel Motor does not rotate
  - Reel Motor defective — Replace
  - Power Condenser for reel motor defective — Replace
- Tape inside Shifter Pin — Re-position tape to outside of Shifter Pin
- Brake will not release
  - Brake Solenoid not operating perfectly — Brake Solenoid defective — Replace
- Program Minder (reel size selector) improperly set — Reset Program Minder

3. Will not Reverse Play

- Will not reverse play only when sensing tape is used
  - Sensing tape improperly affixed — Re-apply
  - Wire broken in sensing pin wiring — Re-connect wire
- Will not reverse play when operating Program Minder only — Program Minder Dial contact point defective — Clean Dial contact point

4. Imperfect Reverse Operating

- When switching from Normal Play to Reverse Play, Pinch Roller does not separate from Capstan — REV 3 Relay defective — Replace Relay
- At Reverse Play, Playback Head does not shift down to position — Reverse Solenoid defective — Replace
- When switching from Normal Play to Reverse Play, tape speed is slow
  - Pinch Roller takes more than 4 seconds to separate from Capstan
    - Capstan Drive Belt is stretched — Replace
    - Fly Wheel has no oil — Oil
  - Pinch Roller takes less than 4 seconds to separate from Capstan
    - Voltage is set lower than standard voltage — Re-set
    - 100 μF Condenser connecting REV 3 series or 47 μF Condenser defective — Replace defective Condenser

5. Does not Rewind

- Rewind Motor does not rotate
  - Rewind motor or power condenser defective — Replace
  - Faulty operation of Rewind Relay — Replace Rewind Relay

6. Will not Operate in Fast Forward Position

- Take-up Motor does not rotate
  - Take-up motor or power condenser defective — Replace
  - FF Relay defective — Replace Relay

7. At Playback Mode, Tape Spills off of Take-up Reel (Forward and Rewind does not operate perfectly)

Take-up motor does not rotate	PLY Relay defective	Replace Relay

8. EXCESSIVE WOW/FLUTTER

Tape hold-back tension normal	Flywheel shaft has no oil or is worn	Clean and oil or replace shaft
	Capstan drive belt is out of shape	Replace
	Capstan motor rotation faulty	Oil capstan motor assembly
	Supply reel motor rotation faulty	Replace motor
Tape hold-back tension abnormal	Program Minder (reel size selector) position does not correspond with reel size	

9. Tape Speed Slow

Tape speed slow regardless of whether set to 7-1/2, 3-3/4, 1-7/8 ips	Capstan drive belt stretched	Replace
	Elywheel shaft has no oil or is stuck	Clean and oil flywheel shaft assembly.
	Capstan motor power condenser defective	Replace
Only one speed out of 7-1/2, 3-3/4, or 1-7/8 ips speeds slow	Capstan motor defective	Replace

SECTION "B" TROUBLES WITH AMPLIFIER

PLAYBACK SYSTEM

1. No Sound from Speakers

- VU Meters register (Output signal from Line-Output)
  - Sound when connected to External Speakers — Internal Speaker defective — Replace
  - No sound when connected to External Speakers — Broken wire in Main Amplifier protection fuse — Replace fuse
  - No sound when connected to External Speakers — Transistor TR-301, TR-302, TR-503, or TR-504 defective — Replace defective transistor
- VU Meters do not register (No output signal from Line-Output)
  - Open circuit in playback head coil — Replace Playback head
  - Playback printed board component defective — Replace defective component part.
  - Plug P00 1 and Jack J301 has come loose
  - No B + Voltage—Diode D0305, D306 or Resistor R301 defective — Replace

2. Sound Distorted

- Normal sound from Line Output
  - Broken wire in main amplifier protection fuse — Replace fuse
  - Main amplifier component defective — Replace defective component part
- Distorted sound from Line Output
  - Playback head worn out — Replace
  - Playback preamplifier component defective — Replace defective component part

3. Loud Hum

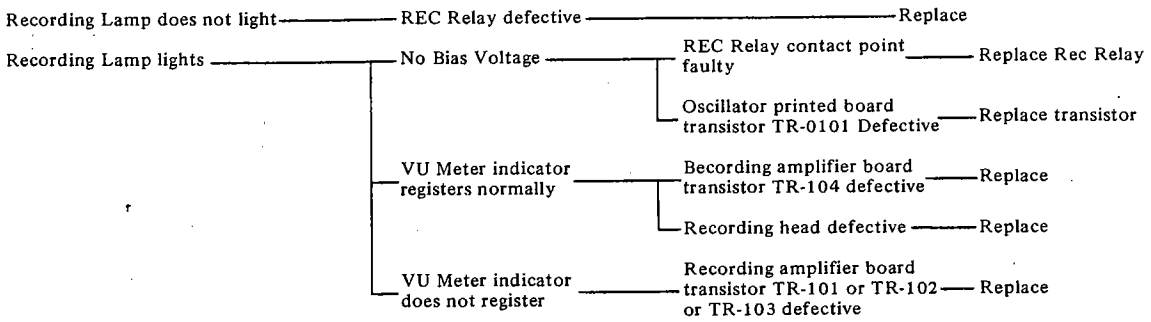
- Hum level unchanged even when Playback head terminal is shorted — B + Voltage Filter Condenser C-302 defective — Replace Condenser

4. Scratching or Cracking Sounds

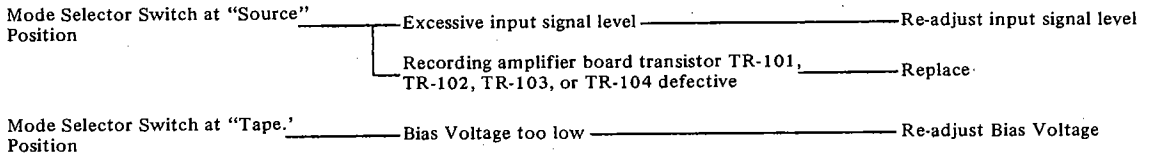
- Noisy during tape movement — Magnetized playback head — Demagnetize playback head
- Noisy at "Stop" mode — Playback preamplifier transistor or resistor defective — Replace defective component
- 5. No Sound at "Reverse Play" Mode — REV 2 Relay contact point faulty — Replace Relay
- 6. Sound Varies at Normal and Reverse Play — Playback head worn — replace

RECORDING SYSTEM

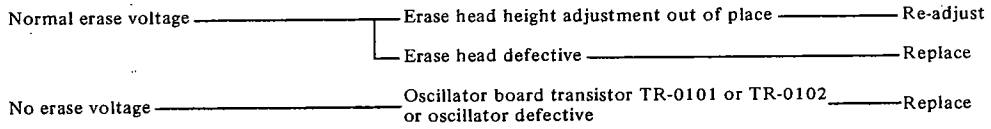
1. Does not Record



2. Distorted Sound


Mode Selector Switch at "Source" Position
Excessive input signal level
Re-adjust input signal level
Recording amplifier board transistor TR-101, TR-102, TR-103, or TR-104 defective
Replace
Mode Selector Switch at "Tape.' Position
Bias Voltage too low
Re-adjust Bias Voltage

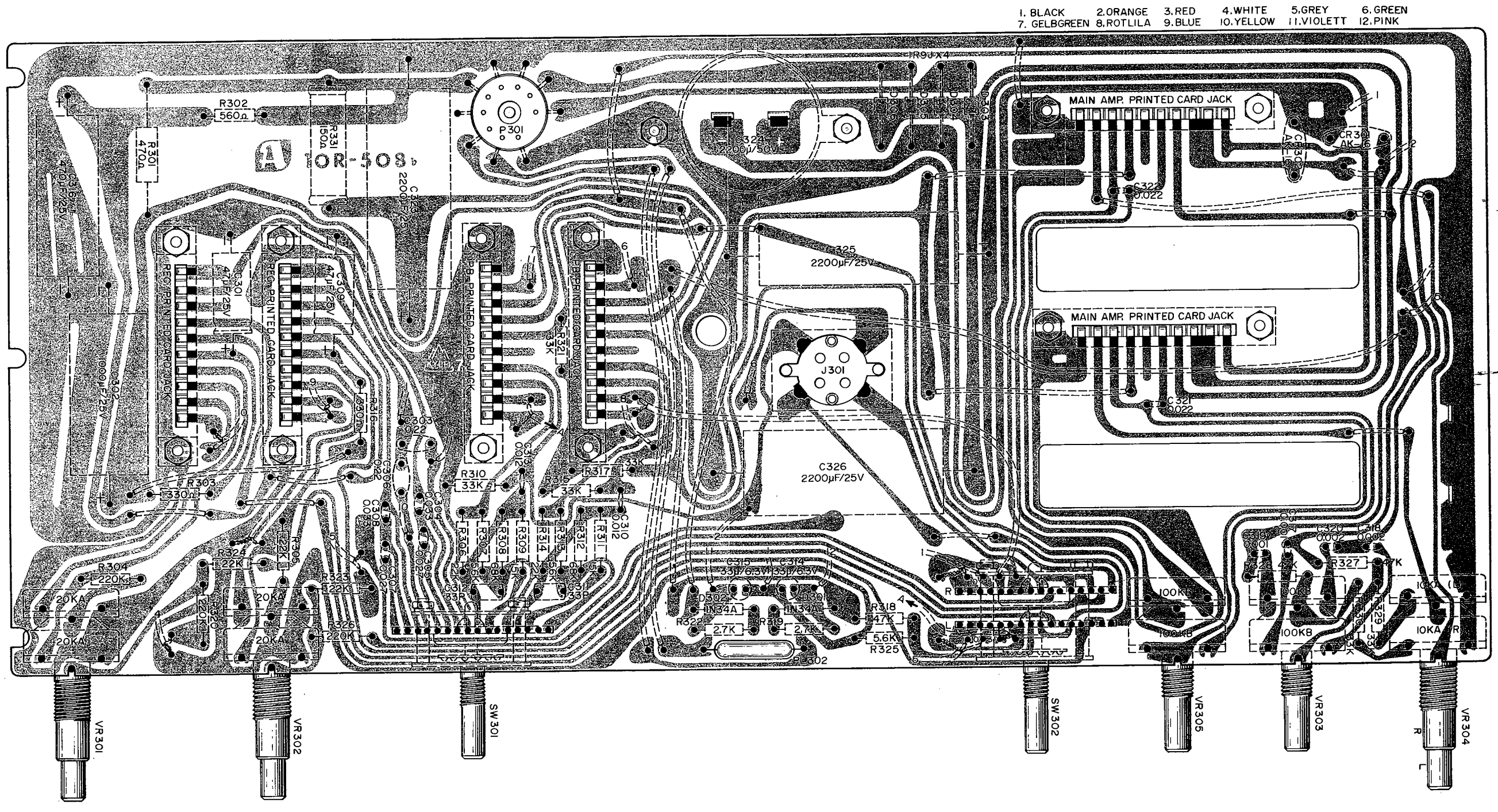
3. Faulty Erasing



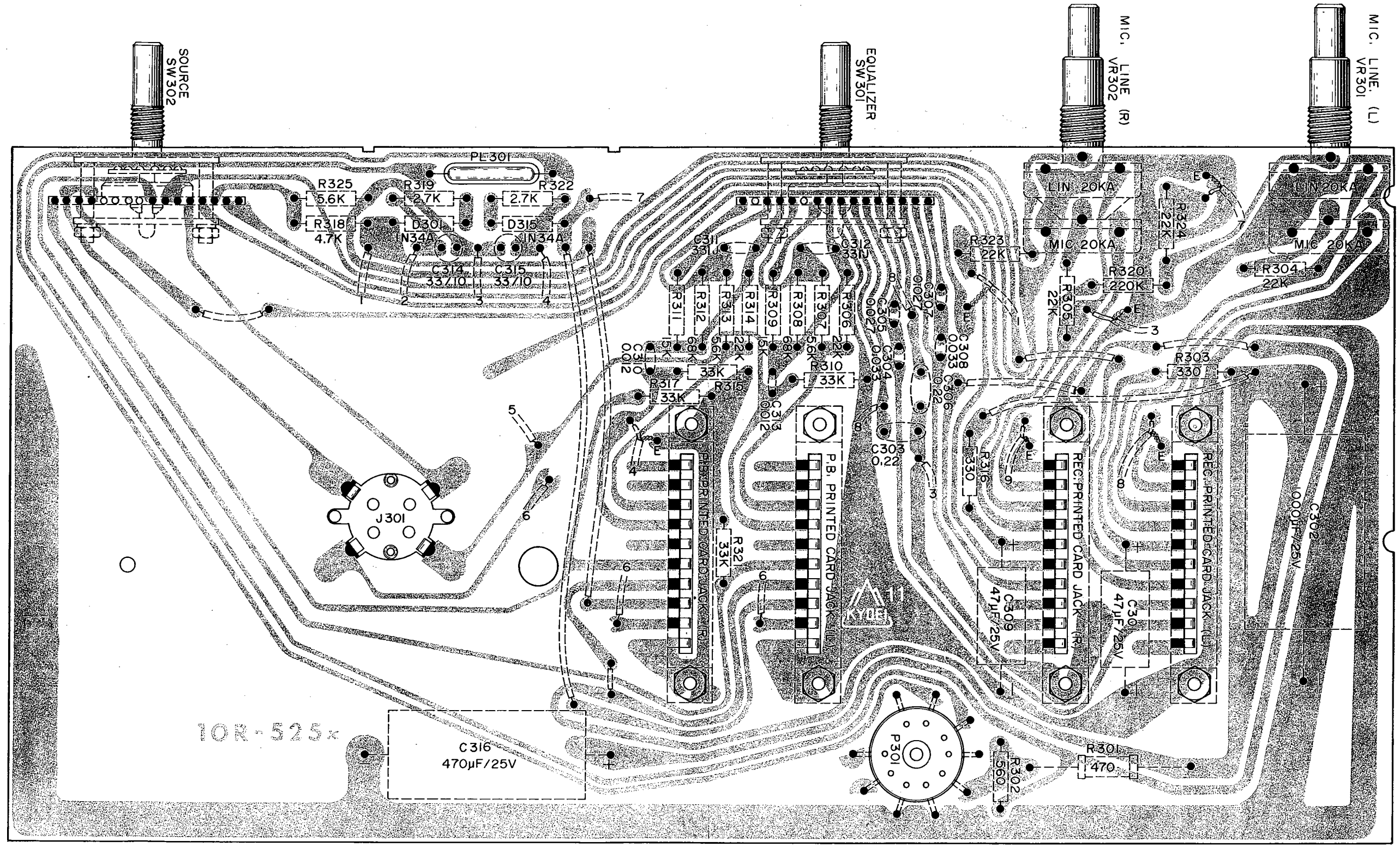
MEMOS

IX. COMPOSITE VIEWS OF COMPONENTS

AMP. CHASSIS PRINTED CARD (10R-508)



AMP. CHASSIS PRINTED CARD (DECK) (10R-525)



1. GREY 2. PINK 3. BLACK 4. PURPLE 5. ORANGE
6. GREEN 7. WHITE 8. YELLOW 9. BLUE

J0602	
1	BRN / WHT
2	SKY
3	RED / BLK
4	YLW
5	YLW / RED
6	ORG / BLK
7	GRN
8	GRN / BLK
9	GLY / WHT
10	WHT
11	WHT / ORG
12	WHT / ORG
13	BLK / BLU
14	YLG
15	PNK

J0603	
1	ORG
2	PNK / WHT
3	BLU
4	WHT / VLT
5	GRY
6	WHT / BRN
7	WHT / RED
8	WHT / GRN
9	WHT / BLU
10	WHT / ORG
11	WHT / BLK
12	BLK / WHT
13	WHT / VLT
14	SKY / BLK

SYS. CON.
IOR 139A 2ED

REMOTE SOCKET J0601

REV SW0001 · NOR SW0002 · SW011 ML-200K (CONTROLED BY PWR SW) · STOP SW0601 · REC SW0602 · PLAY SW0603 · RED SW0604 · F.FWD SW0605 · VV-15-1A

V-1A44 · NOR · REV

RL0601 MY4-0-AD · REV2 · CR0603 AK-17 · R0602 400 5W · R0601 2.2K · CR0601 AK-17 · CR0602 AK-17 · J0602-10 WHT

R0603 1.1K 3W · REC · RL0602 MY4-0-ADI · NL0601 BND-8 · R0604 100K · J0605 · P0204

PLY · RL0603 MY4-0-ADI · C0601 0.01/400 · C0602 0.01/400 · C0603 0.01/400 · C0604 0.01/400 · D0604 10D2 · D0603 10D2

RL0604 MY4-0-ADI RWD · RL0605 MY4-0-ADI FF

R0606 10K · R0607 10K

J0602-1 BRN/WHT · D0602 10D2 · D0601 10D2 · CR0604 AK-17

J0603-4 WHT/VLT · ML-20K · 800 10W · RL001 SDC-840C · REV · D001 10D2 · J0602-11 WHT/ORG · P001

J0603-10 WHT/ORG · J0603-6 WHT/BRN · R001 750 30W · SW 012 ML-20KT

CR001 AK-17 · CR002 AK-17 · CR003 AK-17 · BRAKE · BRAKE · PINCH ROLLER · SHIFT

RL002 SDC-829C · RL003 SDC-829C · RL004 IOCM-K0D · RL005 SPCM-K0D · D002 10D2 · D003 10D2 · J0603-3 BLU

R0638 47K · D0605 10D2 · R0609 47K · D0606 10D2 · C0605 47/160 · C0606 100/160 · C0607 47/160 · C0608 100/160

J0602-4 YLW · J0603-5 GRY · TENSION SW. · SKY/WHT · GRY · ORG · SW017 ML-20K · J0603-13 SKY/WHT · J0603-1 ORG

C0609 47/160 · C0610 100/160 · J0603-14 SKY/BLK · R0611 5.6K · R0612 8.2K · RWD2 · FF2 · RL 0607 MY4-0-ADI · RL 0608 MY4-0-ADI · D0607 10D2 · D0608 10D2

SW018 ML-20K · CR0607 AK-17 · SKY/BLK · GRY · J0603-4 WHT/VLT · J0603-2 ORG/WHT

REV3 · RL 0606 MY4-0-ADI

R0613 1K 15W · J0603-9 WHT/BLU · J0602-13 BLK / BLU · J0602-12 WHT/ORG · J0603-7 WHT / RED · C0611 0.47 / 300

CR0605 AK-17 · CR0606 AK-17 · J0602-8 GRN/BLK · J0602-6 ORG / BLK · J0602-3 RED/ BLK

C0401 15+35/250 · SW0401 · C0402 0.47/300 · SUPPLY MOTOR

J0603-8 WHT/GRY · C0501 15+35/250 · SW0401 · TAKE UP MOTOR

J0602-14 YLG · J0602-7 GRN · J0602-15 YLG/BLK · J0602-2 YEL/BLK · J0603-12 BLK/WHT · J0602-5 YLW/WHT · ORG/BLK

CAPSTAN MOTOR · SW013~016 VV-15-1A · ON TAPE SPEED · OFF · 1-4 OFF 1 7/8" · 1-4 ON 7 1/2" · 1&2 ON 3 3/4"

SW004 ML-200K · ML 001 8V 02A · SW007 ML-20K · SW008 ML-20K · SW009 ML-20K · ML 002 8V 02A · SW005 ML-20K · SW006 ML-20K

SW019 50~60~ · SW020 BRN/BLK BLK/WHT · C001 1+2/250 · CR004 AK-17 · CR005 AK-17 · CR006 AK-17

REEL SIZE · SW021 Y-244 · 5" 7" 10" A B

SW22 PWR SW ML-200K · CONTROLED BY BRAKE · SW010 ML 20K

P002 · P003

CONNECTING
P001—J301
P002—J0301
P003—J0303
J0203—P0101
J0605—P0204

OSC
IOR 523

P0101 · C0101 1800P/500 · L0101 AKI-207 · R0101 5.6K · L0102 SNY 1317A · R0102 180 5W · R0103 820 1/2W · R0104 820 1/2W · R0105 120 · C0102 25 · C0103 50 · C0104 100 16.5 · R0106 10 1/2W · C0105 1/50 · TR0101 2SC968 · TR0102 2SC968

J0201 · J0204 · J0203 · J0202 · SW0201 2-6-3 · C0201 200P/35 · C0202 200P/35 · EH · BH · RH · PH

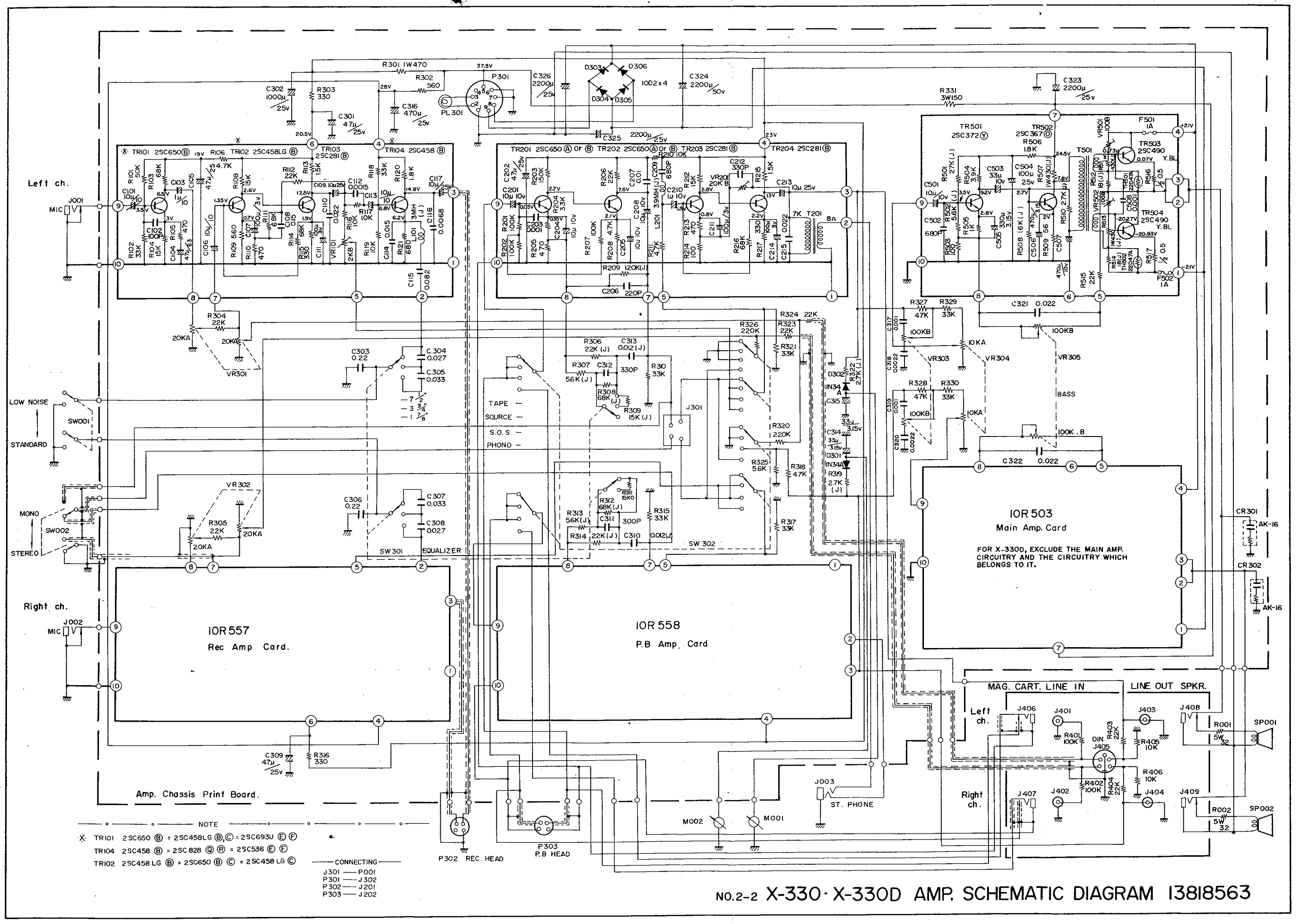
IOR 712

J0301 · R0302 182W · D0302 10D2 · D0301 100/160 · D0303 100/160 · D0304 10D2 · D0305 10D2 · D0306 10D2 · R0301 22K2W · J0302 · C0303 4000/50 · T0301 IORT-1 330 5050 x · IORT-2 330D 5050 xD · F0301 3A (UL) · SW0301 · J0303 · F0302 3A (UL) · J0304 · SW0302 · NOR.ON — AUTO SHUT OFF

TR0501 2SD24 · R0501 1001 22K2W · R0502 47 · R0503 100 · R0504 10 · R0505 470 · TH0501 16047 · D0501 · D0502 · D0503 IN34A · D0504 IN34A

FOR X-330D, EXCLUDE THE 14.5V×2 OUTPUT SECOND WINDING OF TRANSFORMER AND THE CIRCUITRY WHICH BELONGS TO IT.

NO.2-1 X-330·X-330D MECHA & POWER SUPPLY SCHEMATIC DIAGRAM 13818543



NO.2-2 X-330·X-330D AMP. SCHEMATIC DIAGRAM 13818563